6 JANUARY 1956

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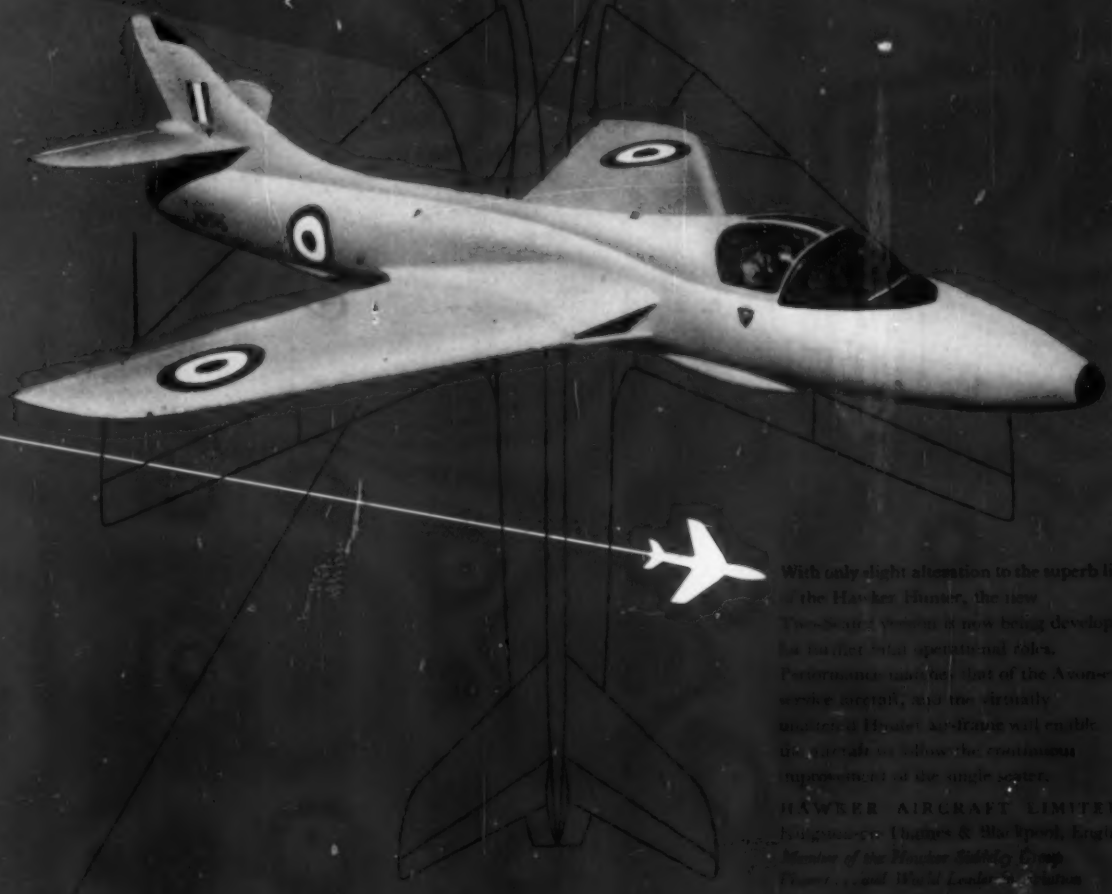

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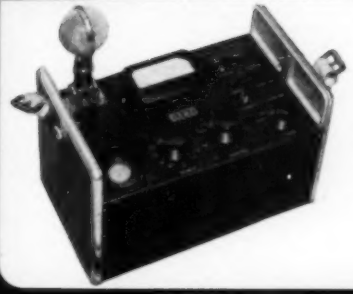
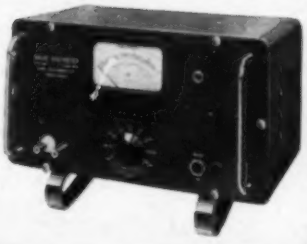
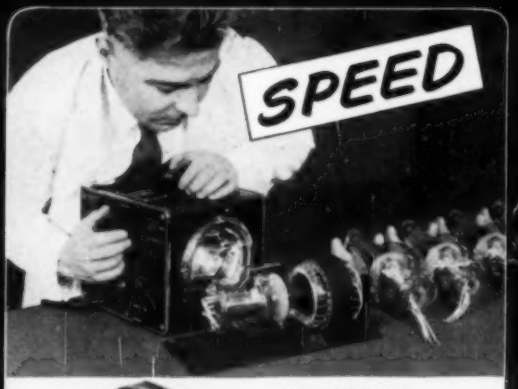


SOUND LEVEL METER
Type 1400D
is seen measuring the rises in noise-intensity set up by a helicopter descending at London's South Bank.

VALVE VOLTMETER Type 613
as used in this Rolls-Royce test-house. Easily modified for use with seismic pick-up for direct-reading measurement of the peak-to-peak displacement component of vibration from a few micro-inches up to 1/10th of an inch.





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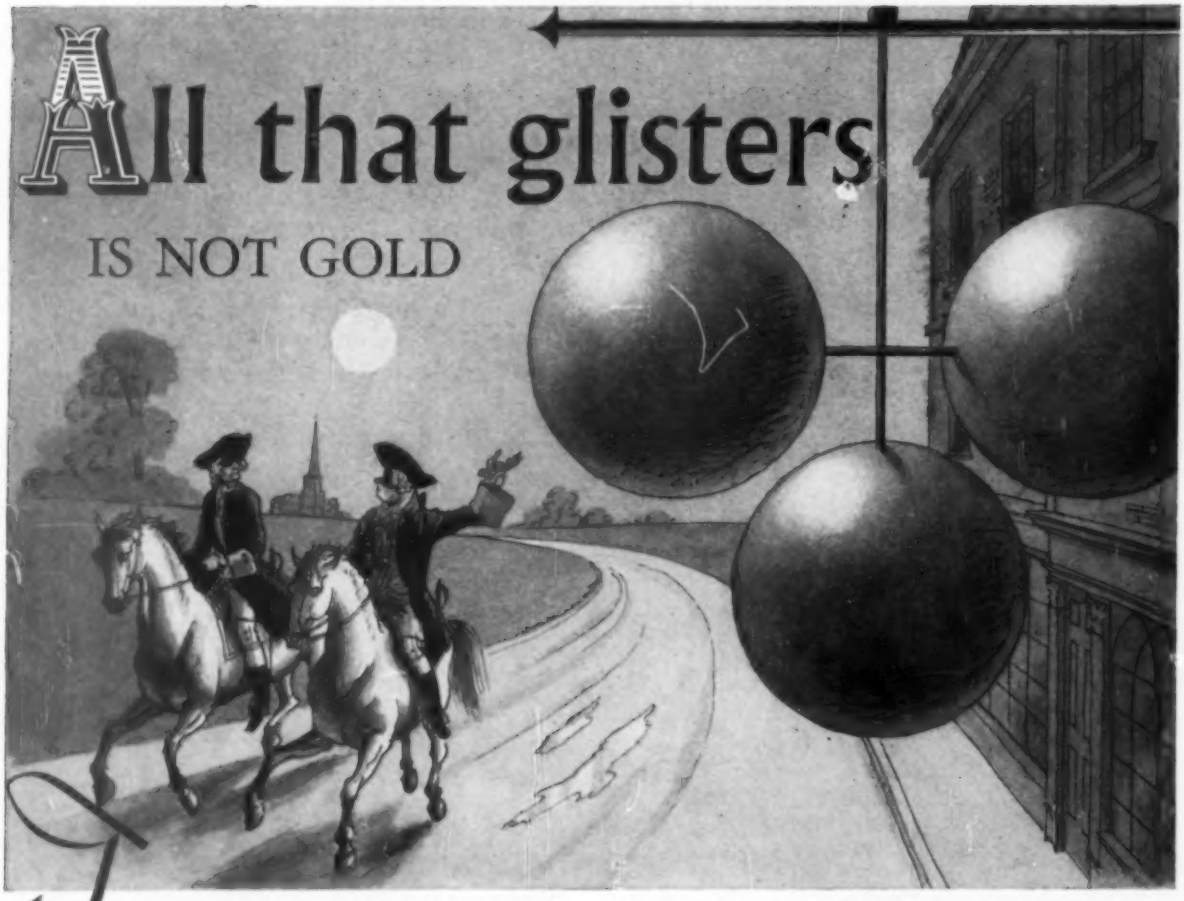


THREE GREAT golden balls glistened in the moonlight. "Zounds!" cried the First Robber —"there's as pretty a sight as ever I did see, all set out werry neat and orderly, and all a-ready for the taking of by two enterprising gents with an eye to business. Do you give me a leg, Skipper, and I'll part 'em from their moorings werry brisklike — afore ye can say Jack Ketch!"

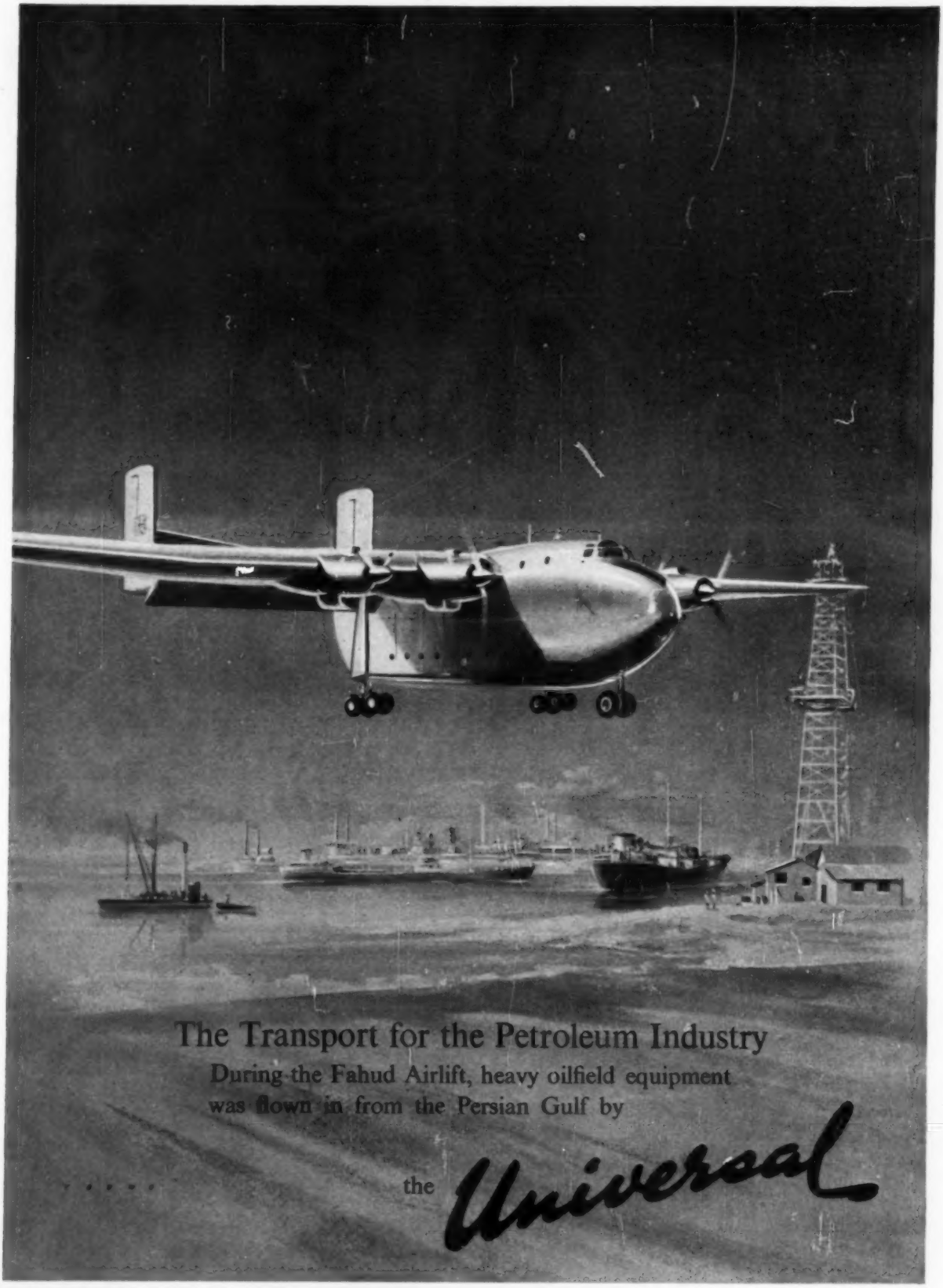
"Tch!" murmured his companion, a man of sharper intellect and wider experience than honest Jeremy — "such simple faith is sadly misplaced, old friend. These globes are neither gold nor other precious metal, being wrought — probably in Birmingham — of brass. Hollow at that —" he added testily, rapping one of them with his cane. It gave out a dull, lack-lustre note.

Jeremy frowned. "Werry misleading and unethical," he muttered, "It's them sort of things from what man's ingratitood springs." He paused, pleasingly fuddled by his little rhyme.

"Speaking of springs," said the Captain darkly, and sounding suspiciously like an advertisement, "there's *another* bone of contention in this imperfect world. Did you know that the cheapest of springs may look every bit as good as the finest quality spring, specially designed and made for ultra-high performance? And, like the three golden balls, it's only when you come to try 'em out that you find you've been conducted up the garden path. Truly 'All that glisters is not gold'! Which reminds me, I really must redeem Lord Hartlebury's timepiece..."

Advertiser's Announcement

M-W.421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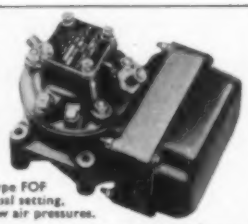
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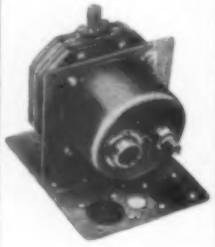
Type PAD Altitude.

Type FGY Fuel pressure.


Type FKK
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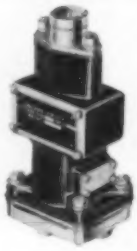
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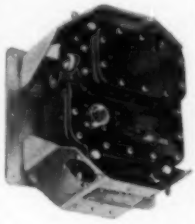
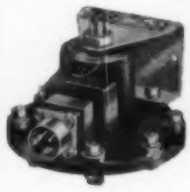

Type FLY Pressure ratio.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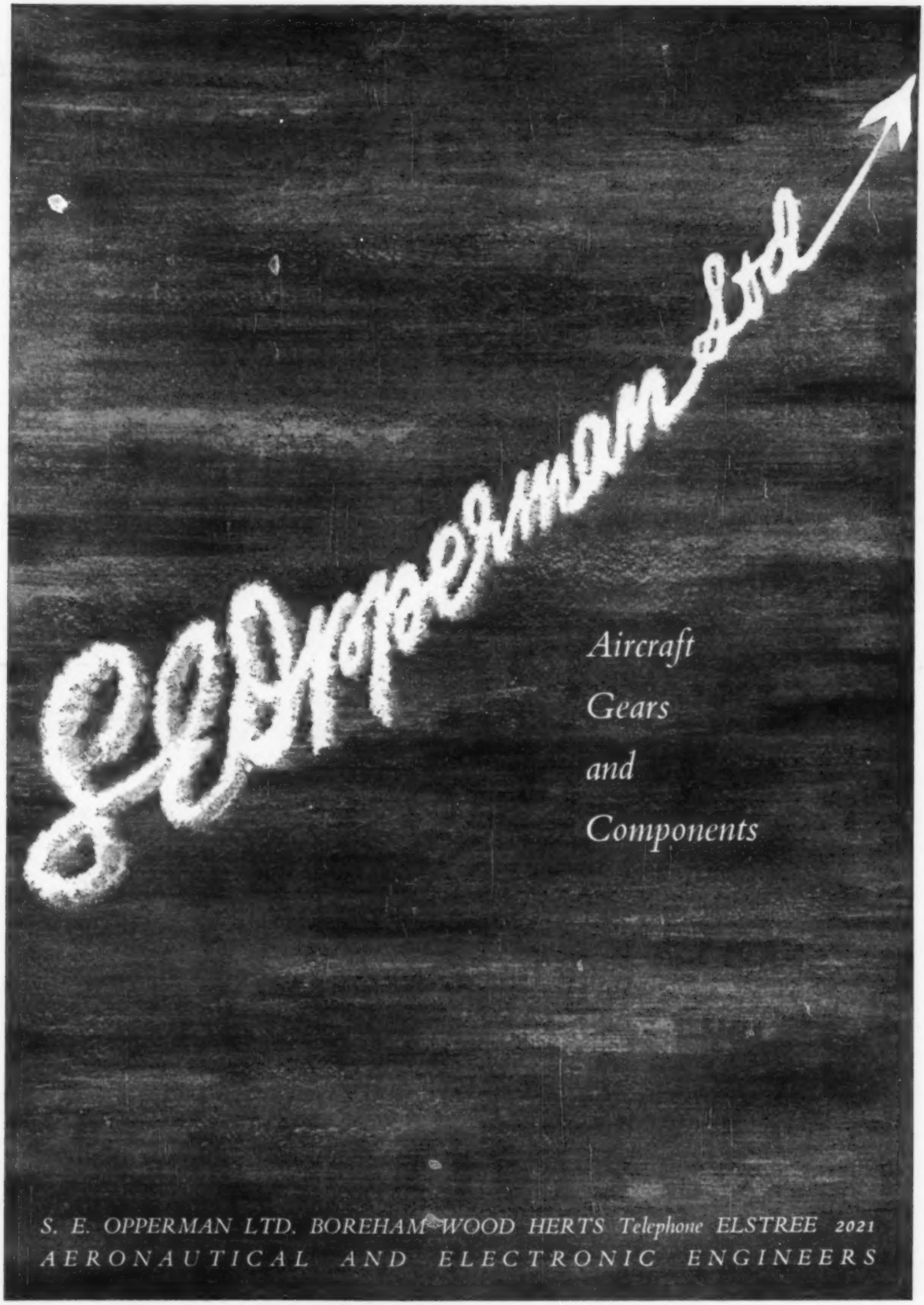
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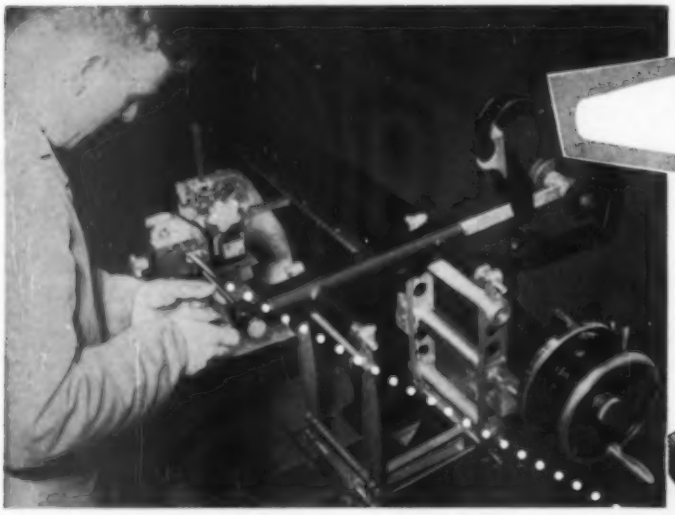

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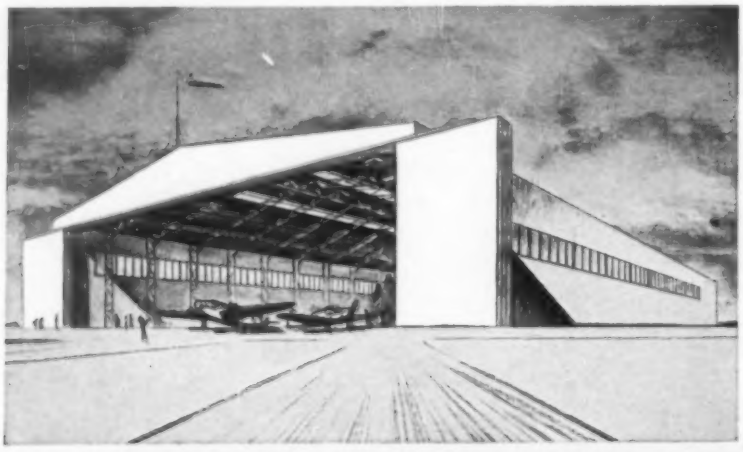

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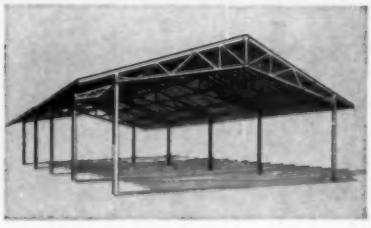

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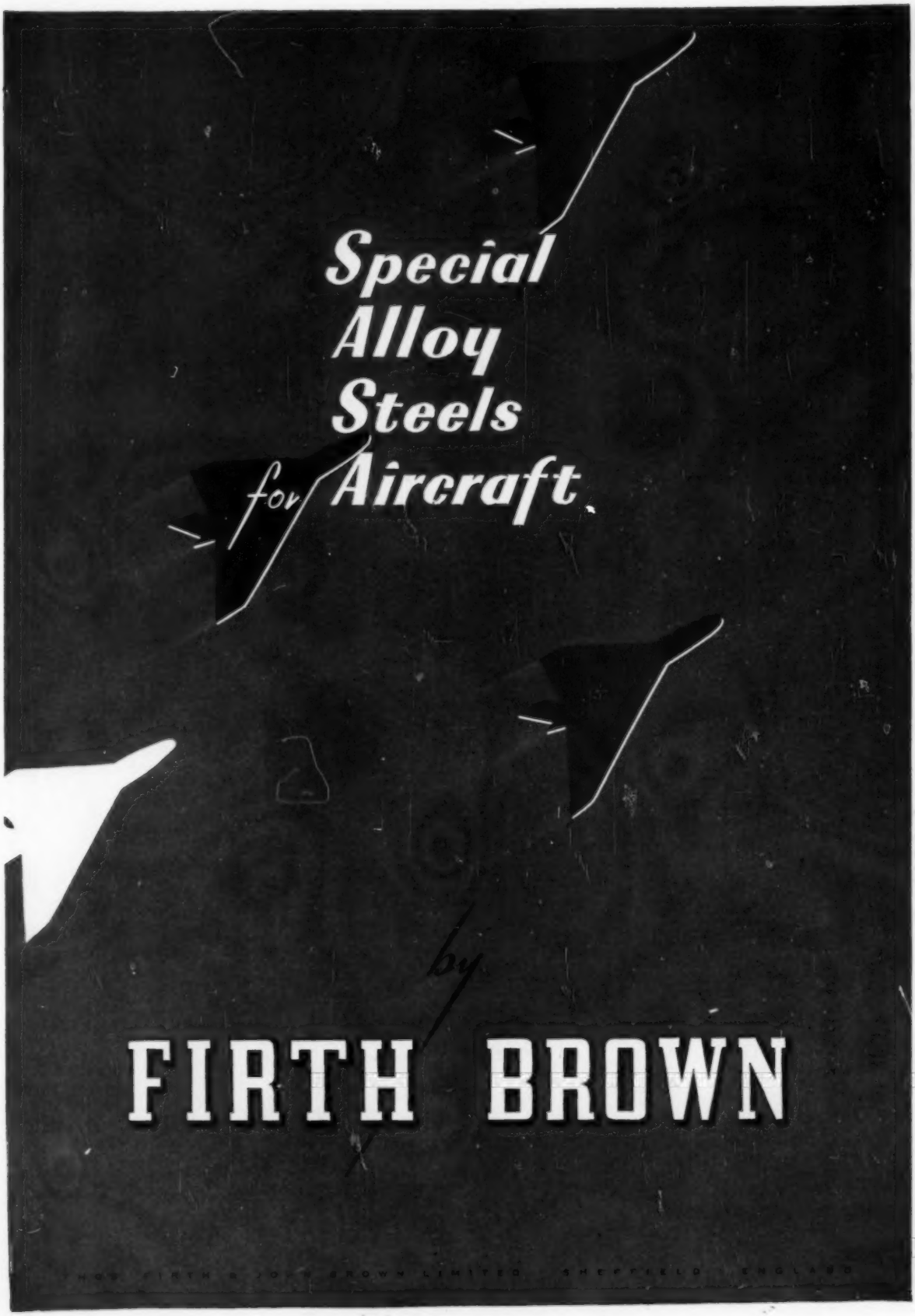
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FIRST AERONAUTICAL WEEKLY IN THE WORLD FOUNDED 1909

FLIGHT
and
AIRCRAFT ENGINEER

No 2450 Vol 69 FRIDAY 6 JANUARY 1956

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Commercial Considerations

EVENTS of the past few days have further modified—in most cases according to expectations—the ever-changing civil-aviation scene, and if ever there was a need for the makers of Britain's airliners to put in a full quota of overtime, it is surely now. Happily, there is little doubt that this is being done at all levels. Exceptional activity is reported from Bristol, Hatfield and Weybridge.

The news in general has not been bad, nor even discouraging, but clearly the slice of turbine-airliner sales which is coming to this country will not be as large as had been hoped. Orders for America's DC-8 and 707 have been quite phenomenal and without precedent in the sums of money involved.

The Viscount continues to make the pace in its own field and at this early stage of its career the Vanguard seems full of promise. Increasing support for the Britannia will, it is thought, depend to a great extent on its early showing on the air routes, and the delivery of B.O.A.C.'s first two aircraft last week was a tonic indeed. The turboprop Britannia has no direct competitor and, with its demonstrated performance and a share of luck against the contingencies which can so affect the future of any new aircraft, it will be capable of sweeping its particular board by the early 1960s.

The first flight of the DC-7C on December 20th was new evidence of the drive which the great Douglas company can put behind a project. There were those in this country who had confidently asserted that this contender could not possibly take the air for months to come.

The Pure-Jet Picture

What of the Comet? Its recently completed world circuit was a resounding success and its performance came as a revelation to many upon whom the printed figures had made only a partial impression. Its non-stop flight from Montreal to London in just over 6 hr—the very first direct crossing by a jet airliner—was, perhaps, the most remarkable demonstration of its performance potential, though even this was not strictly indicative of the Mark 4's capabilities in airline service.

The eagerness of all to fly in the Comet wherever she landed around the world shows that no prejudice remains against jet airliners generally, and in particular this one. It has not passed unnoticed, moreover, that the morning after its return from a strenuous world flight this prototype machine was again airborne over England, giving further demonstrations.

The Comet, our only pure-jet airliner since the Vickers 1000 was abandoned, continues to be of immense national importance, and until—years hence—a new design has been realized it must alone uphold Britain's jet prestige. With the exception of regular and direct Atlantic crossings in both directions, B.O.A.C.'s Comet 4s will be able to handle any arterial routes in the world. This is more than can be said even of the DC-8 or 707—both outstanding machines but, being larger and of longer range, in a class of their own.

Evidently time is once again the all-important factor affecting Comet sales. The technical merit of the machine and the enormous background of knowledge and experience (to be further expanded as R.A.F. Transport Command operate their modified Comet 2s) will not sell it if it is not available at the right time. Although no break-even figure has been mentioned, it is appreciated that the makers must soon be able to see a reasonable number of orders in addition to those already received from B.O.A.C. if they are to proceed with plans for large-scale production. Here again, service—an early return to service—may prove the best sales stimulant.

There is no easy or economical way to speed up development and production, but if the survival of a particular design is at stake, then a way will have to be found. Much as the still-birth of the Vickers 1000 is to be regretted from many points of view, when the difficult decision was taken a few weeks back the aircraft had, on a time basis, lost much of its competitive appeal.

FROM ALL QUARTERS

THE FACE AT THE WINDOW: After many years it is a treat to glimpse the hat-topped countenance of Capt. Edgar Percival, smiling, from the pilot's seat of a new Percival creation —the P.9 agricultural aircraft, fully described in "Flight" of December 30th.
"Flight" photograph

America's New Policy

IN a seven-page memorandum to General Twining, U.S.A.F. Chief of Staff, Mr. Donald Quarles, Secretary of the Air Force, said that a new approach to industrial readiness is essential. "For the first time in modern history," he said, "our nation is faced with a continuous potential threat of devastating destruction at the outset of general war." He went on: "If, in an emergency, we are to survive and minimize the devastation to our nation, the traditional concept of a prolonged industrial build-up after attack must be replaced by a 'readiness' programme." The new policy specifies that industrial resources will be concentrated on the most important aircraft and missiles, such as those for strategic bombing and air defence.

Mr. A. G. Elliott's Retirement

ON January 1st, as foreshadowed some months ago, Mr. A. G. Elliott retired from the post of executive vice-chairman of Rolls-Royce, Ltd. Mr. Elliott, who is 66 years of age, joined the company in 1912, when he was on Mr. F. H. Royce's personal design staff. He was senior designer on the Rolls-Royce Eagle and many subsequent engines, and under Sir Henry Royce he was personally responsible for the design of the "R" engine; the Merlin, too, was his work. He was appointed to the Board in 1945 and became joint managing director in 1951.

Mr. Elliott is succeeded as executive vice-chairman by Mr. Whitney Straight, who joined the Board on November 1st, 1955, having resigned his post as deputy chairman of B.O.A.C.

Senior Officers on Tour

ON January 4th Air Chief Marshal Sir Dermot Boyle, K.C.V.O., K.B.E., C.B., A.F.C., who has recently taken up the appointment of Chief of the Air Staff, was due to leave on a tour of the Middle and Far East Air Forces, returning to the United Kingdom on February 8th. Sir Dermot's itinerary is: Nicosia, January 4th; Mauripur, January 5th; Ceylon, January 7th; Singapore, January 9th; Hong Kong, January 14th; Kuala Lumpur, Malaya, January 18th; Butterworth, January 21st; Bangkok, January 22nd; Delhi, January 23rd; Aden, January 25th; Bahrein, January 29th; Habbaniya, Iraq, January 30th; Amman, Jordan, February 1st; Cyprus, February 2nd; Malta, February 6th; Binbrook, Lincs, February 8th.

The Air Member for Personnel, Air Chief Marshal Sir Francis J. Fogarty, K.C.B., K.B.E., D.F.C., A.F.C., left Northolt on January 2nd in a Hastings for a tour of units of the Middle East Air Force. He was accompanied by his staff and by the Air Officer Commanding, the Records Office (Gloucester), A. Cdre. W. E. V. Richards, C.B., C.B.E. At Abu Sueir on January 5th the air chief marshal was to present a squadron Standard to No. 84 Sqn. of the Middle East Air Force, Transport Wing, which is equipped with Valettas. (Sir Francis was the unit's commanding officer in 1935.) The presentation ceremony was to be attended by Air Marshal Sir Claude Pelly, K.C.B., C.B.E., M.C., Commander-in-Chief, M.E.A.F. Sir Francis will visit Malta, Habbaniya, Bahrein, Aden and Nicosia, returning to Northolt on January 16th.

M.o.S. Appointments

NEW appointments announced by the Ministry of Supply include that of Mr. J. Hanson, at present Chief Superintendent of the Aeroplane and Armament Experimental Establishment at Boscombe Down, to be Deputy Chief Scientific Officer, Structures Department, Royal Aircraft Establishment.

Mr. D. E. Morris has been promoted to the rank of deputy chief scientific officer and will succeed Mr. Hanson as Chief Superintendent at Boscombe Down.

It is also announced that Dr. B. G. Dickins has been appointed Director of Guided Weapons Research and Development.

Mr. Hanson.

Seamew Data Revealed

IT is now possible to publish some details of the Short Seamew light anti-submarine aircraft which have previously been restricted by security classification. There are, in fact, two marks of Seamew, generally similar externally: the AS.1 Naval anti-submarine version and the MR.2 maritime reconnaissance type for Coastal Command.

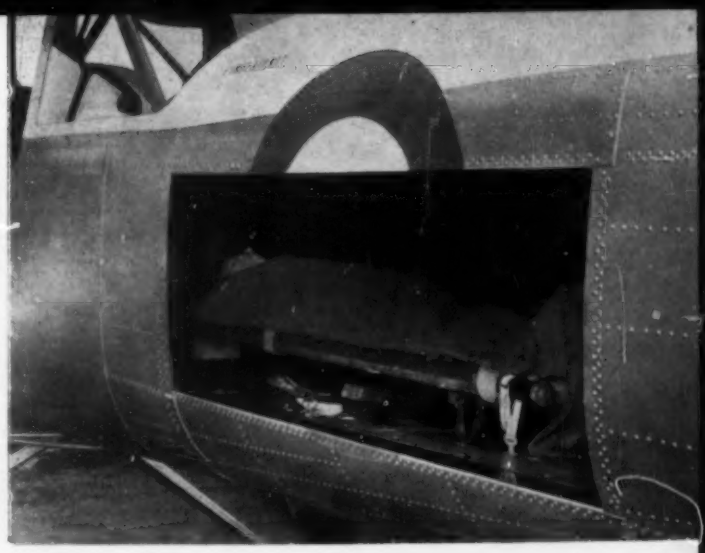
The structure weight for both versions is 4,260 lb, to which must be added powerplant, systems and 1,882 lb of equipment to make up the basic weight of 9,795 lb. The operating weight varies between 10,300 and 10,500 lb and the maximum weight is 14,000 lb, including approximately 1,000 lb of warload. For reduced endurance a considerably greater weapon load can be accommodated. At 14,000 lb the Seamew with the Armstrong Siddeley Mamba ASM.6 turboprop takes off at 60.7 kt after a run of 495ft into a 12-kt wind. Sea-level rate of climb is 1,600ft/min and level speed 211 kt at emergency rating at sea level, or 196 kt at maximum continuous power. Cruising at 120 kt at 5,000ft a four-hour patrol is possible with full allowances, using 326 gal of wide-cut fuel.

Mr. Alfred Faddy

WE are sorry to learn, from Vickers-Armstrongs (Aircraft), Ltd., of the death of Mr. Alfred Faddy, assistant chief designer at the Supermarine works. He was 63.

Of border stock, he served his engineering apprenticeship with Parsons of Newcastle. During World War I he served in the R.N.A.S., spending some time with Porte on the famous Felixstowe

BEECHCRAFT MODEL 73: Photographed on its first flight (December 18th, 1955) is the new tandem-seat Beechcraft Model 73 jet trainer, subject of a news item on page 13. Immediately apparent is a family resemblance to the Mentor piston-engined trainer.



PIONEER AMBULANCE: Equipped, as seen here, as an ambulance, the Scottish Aviation Prestwick Pioneer carries a pilot, two passengers or attendants, and a stretcher case. The stretcher door is not removable but swings up into the fuselage roof. When a stretcher is carried the two rear seats are removed from the cabin.

flying-boats. After the war, he worked as a design draughtsman at Parnall, and he joined Supermarine on July 7th, 1930, when he was 38.

He exerted much influence on many of the Supermarine designs. He was section leader in charge of the Spitfire, working in the drawing office under Joe Smith, then chief draughtsman, and R. J. Mitchell as chief designer, both of whom placed great faith in his judgment and ideas. The detail design of the Spitfire, say the company, was very largely his work, and had he achieved nothing else, he would be assured of his place in aeronautical history by his contribution to the success of that remarkable fighting aircraft.

At the time of his illness, he was in charge of the detail design of the twin-engined Naval fighter Type 113, a development of the 525 which was also his work.

Mr. Faddy leaves a widow, two daughters and two sons.

F/L. H. M. Schofield

REMEMBERED as one of the British winning team in the Schneider Trophy contest of 1927, F/L. H. M. Schofield died in a London hospital on December 29th. He was 56 years of age. In 1934, flying a Monospar S.T.10—he was with the makers, General Aircraft, Ltd., at the time—he won the King's Cup Race. During his flying career, which began in the R.N.A.S. during the First World War, he had a number of lucky escapes, his crashes including a descent in the sea during the preparations for the Schneider Race at Venice, and, in 1935, an accident in an Autogiro. He had not been connected with aviation during recent years.

F/L. Schofield—a Schneider Cup picture.

Sir Frederick Looks Ahead

NEVER did the wit of Sir Frederick Handley Page sparkle brighter than at his company's senior staff dinner in London just before Christmas. Indeed, it seemed quite impossible that he had already celebrated his 70th birthday (November 15th), an event marked by the presentation of an inscribed silver salver by A. Cdre. A. V. Harvey, deputy chairman.

But Sir Frederick's mood was not one of levity alone. He looked to the future in the perspective made possible by such developments as laminar flow ("laminization"). Birds, he remarked, had no turbulence; so men, by mechanical means, might reap incalculable prizes if they could achieve true streamline flow. Introduction of laminar flow he likened to an old cart with a squeaking axle and solid wheels being fitted with ball or roller bearings. We were, he said, on the edge of a great ocean of undiscovered truth, but we had to learn to use the untapped stores of energy around us.

Up in the Comet 3

A KEEN wind cut across Hatfield aerodrome on the morning of December 29th, but in the globe-encircling Comet 3 (see page 12) we chatted cosily with Mr. P. F. L. Hall, senior technical assistant of de Havilland's aerodynamics department.

Mr. Hall cautioned us that, the pressurizing system being a lash-up (to be greatly developed for the Comet 4), air-conditioning would be a fairly noisy process—as, indeed, it proved to be; and, as the fuselage was not fully modified we should not be allowed to fly above 20,000ft, with 4 lb/sq in pressure and 8,000ft cabin altitude. The Comet 4 would be pressurized to 8¾ lb.

On the world tour, said Mr. Hall, the Comet 3 had settled into cruising flight at about 35,000ft, rising gradually to 40,000-42,000ft, though on the longest stage she touched 44,000ft. No demonstrations had been given above 20,000ft.

With the Avons revving, John Cunningham positioned the aircraft for take-off and opened up against the brakes. There was a precipitous release, a mighty urge, and in seconds we were thrusting up from a Farnborough-style demonstration take-off, with—in our own range of vision—the port wing flexing gently in the disturbed air and the pinion tank nodding in sympathy.

As we carried on up to our appointed level at a rate of 2,500ft/min, scouting around Southern England for clear skies, a civil-registered Comet 2, which had taken off seconds ahead of us, tucked in alongside—a rare picture of grace.

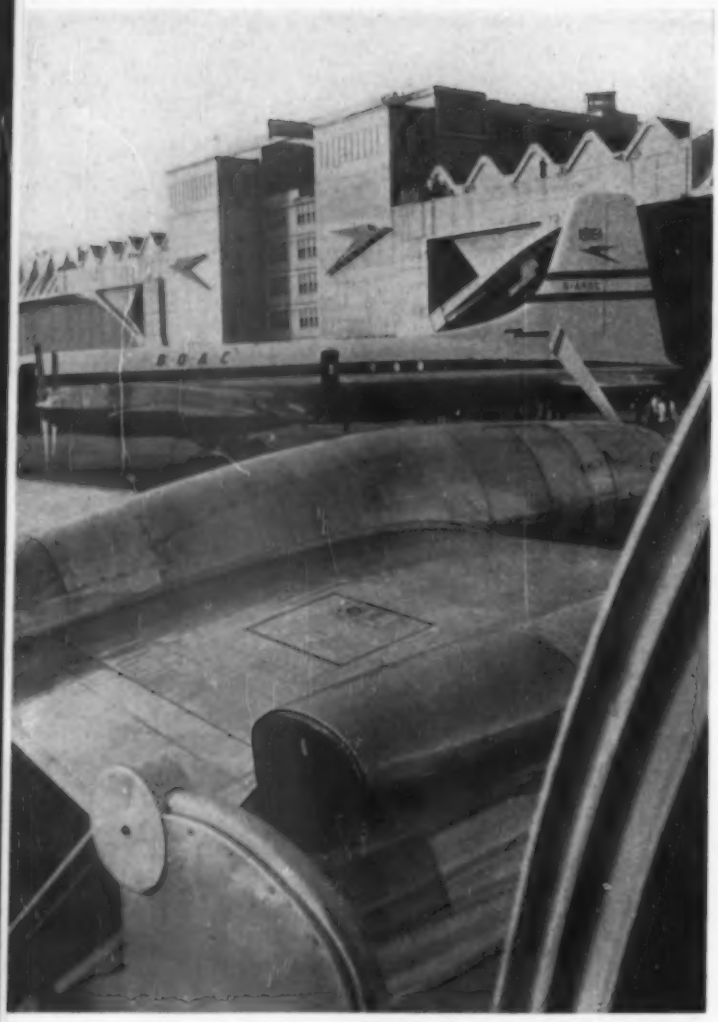
We remarked to John Cunningham on the discrepancies in jet-pipe temperatures, and were chastened by his polite explanation that, as he was having to cruise at half designed altitude and on something like half power, he was flying mainly on two engines—the outers—with the inners idling. Indicated speed was 220 kt. Cockpit inscriptions declared the never-exceed figure as 270 kt.

Such figures, however, are merely for the curious. For the operator and passenger it is more relevant to remark that the recent world flight was made with the exterrial configuration and drag of the Comet 4 (though the capability and economy of that mark will be superior), and that among the stages flown were: Cairo-Bombay, 5 hr 11 min (523 m.p.h.); Singapore-Darwin, 4 hr 39 min (451 m.p.h.); Sydney-Auckland, 2 hr 40 min (501 m.p.h.); Fiji-Honolulu, 6 hr 56 min (458 m.p.h.); Vancouver-Toronto, 4 hr 12 min (495 m.p.h.); Montreal-London, 6 hr 18 min (515 m.p.h.). In fact, the Comet's average speed on this last stage from set course to overhead London was nearer 550 m.p.h.

SHOULD AULD ACQUAINTANCE—: In the presence of many veteran Dutch pilots, the Fokker F.VIIA, H-NACT, was transferred to the keeping of a museum in the ceremony here recorded. Honouring the old-timer was its newest descendant—the Dart-powered Friendship prototype, PH-NIV.

BRITANNIAS JOIN B.O.A.C.

Baker Charlie and Baker Dog now with the Corporation



"Flight" photograph

SHORTLY before 10 o'clock on the morning of December 30th, 1955, Mr. J. D. Profumo, Joint Parliamentary Secretary, M.T.C.A., signed the Certificate of Airworthiness for the Bristol Britannia Mk 100. This welcome news was promptly flashed to the maker's airfield at Filton, where, just 90 minutes later, two Britannias took off on their delivery flights to B.O.A.C. at London Airport.

These aircraft, to be joined in course of 1956 by 13 more Britannia 100s ordered by B.O.A.C., were formally handed over to Sir Miles Thomas, the Corporation's chairman, by Sir Reginald Verdon Smith, chairman of the Bristol Aeroplane Co. "We are very glad," said Sir Miles, "to have possession of these first two Britannias—the largest, fastest, steadiest and, I believe, the most economical turboprop aircraft in the world." B.O.A.C., he continued, would push ahead rapidly with the rest of their training programme and would lose no time in starting their route to Johannesburg and, later, to Sydney [Colombo, Ceylon, and other Eastern cities are also on the Britannia's "map"]. One of the three weekly services to Johannesburg, Sir Miles disclosed, would be a two-stop service, calling at Cairo and Nairobi only.

The Britannia's C. of A., which is unrestricted, comes three years and four months after the first flight of the prototype (on August 16th, 1952). This period is not, as has sometimes been inferred, unduly long for such an aircraft. The award of the C. of A. was delayed, however, by the decision—taken at a relatively late stage of the development programme—to subject the aircraft to water-tank testing and to a series of intensive route-proving trials. Britannias now have to their credit over 2,700 flying hours and 20,000 "tank hours," and Bristols have fairly claimed that the test and development programme has no precedent in world aviation.

The two aircraft delivered last week were G-ANBC and G-ANBD, third and fourth respectively to leave the assembly line at Filton. One, "Baker Charlie," was furnished as a 90-passenger tourist aircraft (the Britannia 100 may well perform the bulk of its revenue service for B.O.A.C. in this form); its companion, "Baker Dog," was fitted out as a first-class 54-seater. Their journey provided the first opportunity for us to experience the majestic comfort of travelling aboard fully furnished and soundproofed Britannias.

In Baker Dog. The Associate Editor, who flew in G-ANBD, the first to be delivered, gives these impressions of the journey:

So gracious and spacious did the 54-seat interior (with its lounge bar between the two cabins) appear to us on entering, that we were instantly reminded of the Empire boats. Our host, Peter Masefield—who is now managing director of Bristol Aircraft, Ltd.—greeted us with the news that an unrestricted C. of A. had been granted only a few minutes before we stepped aboard, and he told us something of the final month of effort exerted by all at Bristol to get Baker Dog and Baker Charlie into B.O.A.C.'s hands before the year's end. These machines, he believed, attained higher standards of serviceability and acceptability than any others of their kind yet delivered in new form, either in Britain or the U.S.A. He referred with evident pride to the recent tailplane icing tests, which had entailed the fitting of a rig between two of the engines and the spraying of the tailplane with water to build up ice and thus to prove the thermal de-icing system and establish flying qualities in the event of system failure. Both objects were achieved to the satisfaction of the A.R.B.; the aircraft handled as required with more than 5in of ice on the leading edge of the tailplane, and when the thermal de-icing system was applied the ice vanished inside 15 sec.

Up-front we had two B.O.A.C. captains—S. W. Walton and T. Marsden—and when their cockpit checks were complete the Proteus were successively brought to life and the Britannia swung on to the runway. When the brakes were released she thrust forward with a throbbing hum, was off in about 20 sec and nosing up in a 3,000ft/min rate of climb at 200 kt. Take-off weight was 130,000 lb and we carried 2,000 gallons of fuel—sufficient to get us to Rome.

Off-hand assessment of noise levels is of dubious value, especially so as individual machines of a batch may vary considerably in degree of quietness. But we would personally judge that the overall level of noise in the Britannia's cabin is of the same order as in the Viscount, possibly better, and without the characteristic whine. As Dr. Hooker reminded us, however, we were flying at a relatively low level (6,000ft) and were taking quite a lot of power out of the engines, whereas at the level and power setting for normal cruising (20,000-plus feet) an improvement could certainly be expected.

Our schedule went to pot when we were stacked over Watford, but we were cleared at length to land on L.A.P.'s Runway 33. The undercarriage came down with a noticeable thump and bogied wheels kissed the runway at a circumspect 90 kt. This, Mr. Masefield assured us, was a shade higher than usual. Reverse thrust put an uncompromising curb on the proceedings and we drew to a halt to await Baker Charlie. At length the pair of us advanced to the vast B.O.A.C. hangar, where a dais was brought forward and Sir Reginald Verdon Smith and Sir Miles Thomas voiced the sentiments of the builders and operators respectively, and Sir Reginald handed over the two log books. A photograph of the ceremony appears on page 27.

Aboard Baker Charlie. Our observer in the second of the Britannias to reach London Airport (in the hands of Capt. A. S. M. Rendall, flight superintendent of the Britannia Fleet) was perhaps even more impressed by the spaciousness of the aircraft. Though G-ANBC carried a full complement of 90 passengers, there was no feeling whatsoever of crowding, and it was possible to roam the length of the cabin without undue difficulty. "Tube effect" is absent, for two reasons: the great girth of the fuselage, which permits six-abreast seating; and the installation of an amidships bar. Space remains for a large galley and four toilets.

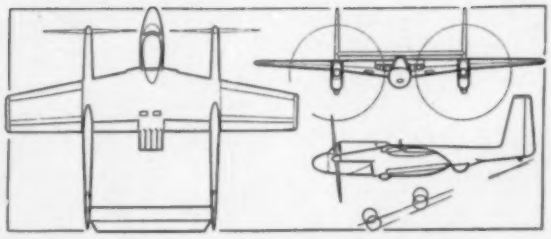
Fairchild's S.T.O.L.

THE accompanying general-arrangement drawing depicts an S.T.O.L. (short take-off and landing) design, a prototype of which—designated M-232—is at present being constructed by the Aircraft Division of the Fairchild Engine and Airplane Corporation, of Hagerstown, Maryland. The concept has been generally worked out by Mr. W. E. Hunt, of the Wiggins-Hunt Engineering Corporation, who hold a joint patent for the design with Mr. E. A. Blonquist, of New York City.

In the early 1930s Mr. Hunt had been engaged in the design of the Crouch-Bolas Dragonfly, a well-known slow-flying biplane in which almost the entire wing area was subject to slipstream from two large airscrews. Previously the same technique was patented by Dr. A. Zahn (1917), although in this case there were no fewer than five lifting surfaces, one above the other, and three airscrews. A generally similar principle—that of making the entire wing subject to slipstream—was employed in 1940 in this country by both Airspeed, Ltd., and General Aircraft, Ltd., in their designs of fleet shadower aircraft. Both these designs were fully slotted and flapped, and were powered by four Pobjoy radial engines distributed evenly along the wing.

In the new Fairchild, power is provided by a pair of buried Lycoming SO-580 piston engines, which pass some 800 h.p. to a gearbox and drive-shafting incorporating over-running clutches. The 13ft-diameter airscrews, placed well ahead of the wing and tilted slightly downwards, have provision for pitch variation and flapping after the manner of helicopter rotors. In the take-off configuration much of the air handled by the airscrews is deflected downwards through a considerable angle by the wing, which has full-span slats and trailing-edge flaps. It is intended ultimately to make the airscrew axes variable in order to satisfy the requirements of take-off and cruising flight.

One obvious disadvantage of such layout is that the design of



the airscrew blades cannot be that for peak efficiency in both slow-speed and cruising flight, particularly in view of the fact that Fairchild are aiming at a cruising speed considerably greater than 200 m.p.h. General stability and control problems at low airspeeds will also be acute, a particular difficulty being the achievement of an adequate smooth airflow over the fixed tail surfaces. The consequences of failure of the transmission shaft (either on one side or on both sides) would also seem to be disastrous at low air speeds. Nevertheless, this is the first time that a completely integrated design of this nature has been translated into metal, and flight trials may, in fact, show that such aircraft combine many of the virtues of the helicopter without the attendant shortcomings in performance and high operating cost.

The prototype is rapidly approaching completion and should certainly fly before the middle of this year. The work is being financed by Fairchild.

Fairchild M-232 experimental short take-off and landing aircraft powered by two Lycoming SO-580 flat-eight piston engines driving airscrews through shafting: Span, 39ft; length in flying position, 29ft 6in; length of nacelle, 18ft 4in; distance between centre lines of airscrews, 17ft; ground angle, 25 deg (landing) or 22 deg (take-off). Maximum weight, 7,000 lb; accommodation, pilot plus passenger; also provision for belly nacelle accommodating eight men or four stretchers. Short-field requirement, to be able to use 500ft clearing with 50ft-high surround; cruising speed, 242 m.p.h.

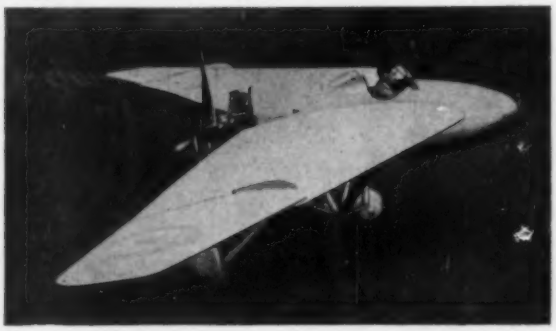
PROFESSOR G. T. R. HILL

IT is with deep regret that *Flight* has to record the death of Prof. G. T. R. Hill, M.C., M.Sc., M.I.Mech.E., F.R.Ae.S., whose name will always be associated with the Pterodactyl tailless aircraft. He died in Londonderry at the Christmas week-end after several years of ill health. He was 60. Prof. Hill had taken up farming after his retirement, in 1954, from the post of chief aeronautical consultant to Short Bros. and Harland, Ltd.

Geoffrey Terence Roland Hill was educated at University College School and University College, London. While he was still in his early teens he achieved prizewinning credit as a builder of model aircraft, in which pursuit—and subsequently in the construction of a near-successful full-scale glider—he shared the enthusiasm of his brother, who was later to attain fame both as an aeronautical artist and as a senior officer of the Royal Air Force—Air Chief Marshal Sir Roderic Hill.

After obtaining a B.Sc. in 1914, G. T. R. Hill joined the Royal Aircraft Factory as a graduate apprentice. From the outset the practical side of flying attracted him even more strongly than the theoretical, and by 1916 he had obtained a commission as a 2nd lieutenant in the Royal Flying Corps; he fought in France with No. 29 Sqn., was awarded an M.C., and was later invalided home with the rank of captain. Test piloting attracted him, and by 1918 he was in command of the Aerodynamics Flight at Farnborough. When the war ended he went to Handley Page, Ltd., as their chief test pilot, and in 1919 took

Prof. Hill with the Pterodactyl Mk. 1a. The heading portrait was taken in more recent years.



a W.8 up to nearly 14,000ft—a world record for an aircraft of 1,500 kg all-up weight.

Even in the earliest days at Farnborough, Hill had been gravely concerned at the phenomenon of stalling, and its results; and the thought which he had devoted to the problem crystallized in the design of the Pterodactyl, which he first flew as a glider in 1924 and with an engine a year later.

Impressed by the design, the Westland company undertook to develop it, and Capt. Hill joined their organization. During the next seven years, five marks of Pterodactyl appeared, of increasing size and power; the last, the Mk V of 1932, was a two-seater fighter powered by a Rolls-Royce Goshawk, weighing 5,100 lb with military load, and capable of 190 m.p.h. at 15,000ft. Throughout the series Hill's object had been—in his own words—"to try to design an aeroplane which would never, through an error on the part of the pilot, get out of control."

Between the wars, academic distinctions began to come his way, and in 1934 he was appointed to the Kennedy Chair of Mechanical Engineering at University College, London. Five years later he was seconded to the Air Ministry, and subsequently to the Ministry of Aircraft Production, for special research work. In 1942 he acted as a scientific liaison officer between the British and Canadian Governments.

At the end of the war he acted as a consulting engineer, notably to Short Bros. and (in 1947-50) General Aircraft; in 1948 he retired from his University College chair, but continued with a number of activities in Ulster; he was a special lecturer to Belfast Technical College, and president of Belfast R.Ae.S. branch.

The final years of Prof. Hill's career brought no diminution in his ability as a designer. Just as the problem of the stall had occupied him in earlier days, so did he now bring his analytical mind to bear on the problems surrounding the control of high-speed, high-altitude aircraft. His approach was the aero-isoclinic wing, the aerodynamic and structural behaviour of which are such that the incidence at any section remains constant in the face of deflections caused by flight loads. In order to test this wing an *ad hoc* aircraft, the Short Sherpa, was prepared. A particular feature of the Sherpa is the use of rotatable wing-tips for both lateral and pitching control—in a manner not unlike that employed on Hill's Pterodactyls.

FOR G.I. JOE: Being installed in a Radioplane RP-71 drone on the left is a U.S. Army Signal Corps K-25 camera, controlled by radio. This type of drone, it is considered, could provide front-line troops with battlefield intelligence in a matter of minutes, since it is small enough to be brought up to, and operated at, the front. On the right is the Aerocycle helicopter designed for infantry use, having a maximum speed of 65 m.p.h., a range of about 150 miles, and able to carry a load of about 300 lb. Twelve of these 44 h.p. machines have been ordered.

HERE AND THERE

Exports Up Again

BRITISH aircraft exports for November totalled £6,524,363. This is almost double the figure of £3,460,983 for November, 1954. For the first eleven months of 1955 exports stood at £59,472,801—over £8m more than in the corresponding period of 1954.

One-Dart Viscount

WITH only one of its four Darts operative, a B.E.A. Viscount made a successful emergency landing at the military airfield of Cazaux, near Bordeaux, on Monday during a scheduled flight from Gibraltar to London. First reports attributed the failure of three power-units to fuel contamination. The aircraft, carrying 31 passengers—who continued their journey in another Viscount, from Bordeaux—was piloted by Capt. E. Watts.

Vampires for Jordan—

AS foreshadowed in our issue of November 18th, 1955, the Royal Jordanian Air Force (previously known as the Arab Legion Air Force) is being given de Havilland Vampire F.B.9s by the British Government. Six were delivered by R.A.F. crews on December 31st and four more should by now have followed. These aircraft will form the nucleus of the R.J.A.F. and will operate in co-operation with R.A.F. squadrons based at Amman and Mafrak.

—and for Indonesia

THE Indonesian Air Force announced in Djakarta on January 1st that six Vampire Trainers had arrived in Indonesia by sea. These, it was remarked, were the first British jets supplied to the Indonesian Air Force, and they are being assembled at a base near Bandung, West Java. They will be flown by British-trained pilots.

Amy Johnson Scholarship Winner

THE Women's Engineering Society, which administers the Amy Johnson Memorial Fund, announces the award of the Amy Johnson Flying Scholarship for 1955 to Miss Janet L. Ferguson. Miss Ferguson, who was chosen from 13 candidates, is secretary and timekeeper at the Denham Flying Club; she is also hon. secretary of the recently formed British Women Pilots' Association. The scholarship, which is valued at £150, was offered to assist a woman holder of a Private Pilot's Licence to qualify for an Assistant Flying Instructor's Certificate.

A Great Story Attracts

AN inquiry conducted by a film trade journal to find which films shown in Great Britain in 1955 had earned the most money has shown that *The Dam Busters* was the most profitable of the year.

Metropolitans for R.A.A.F.

A DECISION by the Royal Australian Air Force to purchase two Convair 440 Metropolitans for the R.A.A.F. Transport Command was announced recently. The decision has caused considerable surprise in Australia, since the R.A.A.F. have been considering the use of Viscounts for its V.I.P. operations for some time.

The Old Honours the New

THE Worshipful Company of Coachmakers and Coach Harness Makers has recently "adopted" the light fleet carrier H.M.S. *Centaur*, which was launched by the Duchess of Kent in April 1947 and first commissioned in September 1953. The event was marked by a Court and Livery dinner at the Tallow Chandlers' Hall, London, last Tuesday, when staff, sash and gauntlets for use by the drum major of the ship's volunteer band were presented to the Captain and officers.

Al Mooney Joins Lockheed

SOMETIMES known as "the Dean of light aircraft designers," Al Mooney has joined Lockheed's Georgia Division at Marietta. Mooney, who designed his first aircraft when he was 19, was responsible for such celebrated types as the Mooney Mite, Mooney Mark 20, the Culver Cadet and the Eaglerock. The Mite still holds the under-500kg world class record of more than 1,300 miles for an unrefuelled flight.

Eyes Over The Ice

IN a cable to London last week, Dr. Vivian Fuchs, leader of the Commonwealth Trans-Antarctic Expedition, was able to report that one of the Austers carried in the expedition's vessel *Theron* had soon been instrumental in assisting the ship to find her way out of thick ice-floes. He cabled: "After encountering heavy ice 25th, finally reached impenetrable area 26th . . . First air reconnaissance flight made 2200 hr 25th December. Successful in finding route through impasse." The Auster pilot was S/L. John Lewis.

Mr. Profumo Indisposed

THE Joint Parliamentary Secretary to the Ministry of Transport and Civil Aviation, Mr. John Profumo, entered a London hospital on Monday for a minor operation. He expected to be away from his desk for about ten days.

Communist Strength Assessment

THE commander of the United States Far East Air Force, General Laurence Cuter, said in an article in a Service journal last week that the Communists in the Far East had more than 7,000 aircraft, about half of them jets, compared with some 2,000 American aircraft.

Pussyfoot Prowls Again

THE U.S. Methodist Board of Temperance has started a campaign against the sale of alcohol in airliners. Two members of Congress, say the Board, are to press for a Federal ban unless the airlines themselves take voluntary steps. Adds the Board: "The pilots, stewards and stewardesses say liquor is a menace to flying. They ought to be in a position to know."

India and the Gnat

A MISSION from the Indian Government is to visit Folland Aircraft, Ltd., to discuss an agreement, already reached in principle, for the construction of the Gnat in India. It is understood that arrangements are being made for the manufacture of Gnats at the factory of the Hindustan Aircraft Company in Bangalore.

South Bank Air Freight

AN urgent consignment of dresses for the Christmas trade was flown down by B.E.A. from Glasgow to London Airport on December 21st and then collected by an Agusta Bell helicopter, flown by John Crewdson of Helicopter Services, Ltd., and transported to the South Bank site. This was the first air-freight delivery to the London helicopter site.

Plessey

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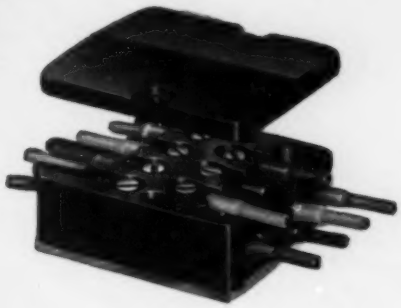
The new Plessey range of superior relays, comprising Open, Dust Cover or Gasket or Hermetically Sealed types, is both reliable and consistent over protracted periods of use and, individually, the relays have unusually good 'G' characteristics. And a recent advancement in the form of improved magnetic circuitry has made possible a lighter, more compact product having greater contact pressures and clearances.

Plessey publication 772, containing complete details, diagrams and tables, is available free to manufacturers – see that your Design Engineers have a copy.



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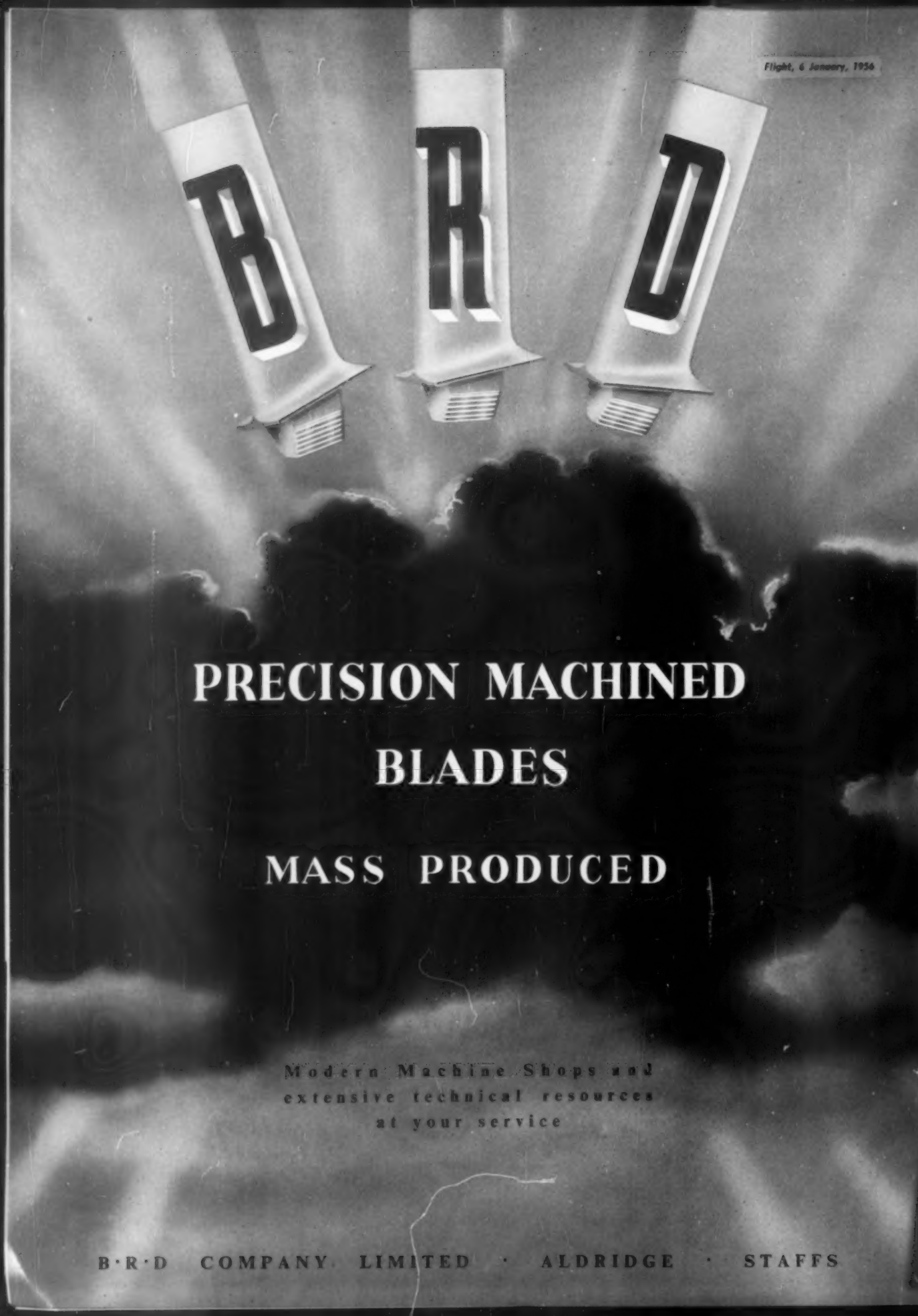
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The Commander (O) welcomes a fresh intake to Part I of the course.

The Methods of the Fleet Air Arm School at Culdrose, Cornwall

By A. CECIL HAMPSHIRE

Training the Naval Air Observer

A FEW weeks ago a group of young Naval officers stood somewhat self-consciously before a ceremonial parade in one of the hangars at Royal Naval Air Station Culdrose. They were about to undergo an ordeal, but it was an ordeal they had eagerly anticipated.

One by one, as their names were read out, they stepped forward to receive from the Flag Officer Aircraft Carriers, Rear-Admiral A. R. Pedder, the gold-winged badge of an observer of the Fleet Air Arm. The Admiral was himself wearing similar insignia above the gold lace on his left cuff.

Later the same evening the newly fledged observers, wings sewn on the left sleeve of their mess dress, clinked glasses with senior officers to whom previously they had been mere "warts" under training. For, by custom, each newly passed-out class of observer trainees, together with the visiting admiral, are entertained to dinner as guests of the wardroom to celebrate the presentation of wings.

The wings ceremony and the dinner that follows were instituted some two years ago and mark the end of nine months' intensive training at the Fleet Air Arm's Observer and Air Signal School. For the instructional staff it merely provides a short breather before turning to greet a new intake.

Candidates for the Observer Branch are today drawn from four main sources. First there is the fleet entry, a general-service lieutenant who comes to Culdrose as a fully fledged naval officer electing to specialize in the flying arm.

Next comes the aviation cadet who has entered the Navy on a short-service commission of either four or eight years. He will have joined between the ages of 17 and 26. Depending upon his age, he holds the rank of either midshipman or acting sub-lieutenant on arrival at Culdrose. Unlike that of his general-service contemporary none of his initial training is done in the Britannia Royal Naval College at Dartmouth. Totalling six months only for the Air Branch, this period is spent in a ship of the Training Squadron based at Portland.

On passing out of the Training Squadron, cadets aged 21 or over are promoted, provided they are recommended, to acting sub-lieutenant and others to midshipman. Midshipmen normally reach the rank of acting sub-lieutenant after sixteen months' service as midshipmen, or on attaining the age of 19½, whichever is the later date. But, provided he is recommended, the midshipman can be promoted to acting sub-lieutenant at the age of 21 regardless of length of service. Subsequent promotion to lieutenant can be attained at any time between one year and eight months and three years as sub-lieutenant, according to results on passing out of training. Thus it behoves the aviation cadet qualifying for observer to do the best he can at Culdrose if he is to gain early promotion to lieutenant.

The third type of candidate is the National Service upper yardman. Provided he has the necessary educational qualifications and passes the Admiralty Interview Board and his flying aptitude tests, he begins his National Service in the Navy as a rating airman. Like the aviation cadet, he undergoes his initial naval training in the Training Squadron, and on passing out he is promoted to midshipman or acting sub-lieutenant (A), R.N.V.R., before going on to Culdrose. On completion of his National Service he will be required to serve for at least five years in the R.N.V.R., on a part-time basis, preferably in one of the R.N.V.R. air squadrons, during which he will do refresher training at Culdrose. Thus the Navy is provided with a reserve pool of trained observers upon which the Fleet Air Arm can draw in time of emergency for manning additional front-line squadrons.

Both aviation cadet and National Service upper yardman are required to possess similar educational qualifications. These are either the School Certificate or its equivalent with a credit in mathematics, or the General Certificate of Education with passes at ordinary level in English, mathematics and one other subject.

Lastly, as the fourth source of supply, comes the upper yardman (air). He is a regular naval rating who volunteers and is selected for aircrew duties. His preliminary training is done in H.M.S. *Hawke*, an establishment equivalent in standard to the Britannia Royal Naval College at Dartmouth. For his observer training he arrives at Culdrose as an upper yardman, wearing blue battledress with white shoulder flash and white cap-band. On successful completion of the course he will be commissioned as an acting sub-lieutenant. Thus he has even more incentive to qualify than his classmates, since this launches him on his career as an officer.

The flow of entries from these three sources is fairly even and, with the Fleet Entry, provides just about sufficient observers for the Navy's needs today.

R.N.A.S. Culdrose—which, though it bears the ship name H.M.S. *Seahawk*, in fact has an old Seafire as a "figurehead"—is close to the Lizard and Land's End, and is thus admirably sited for the specialized type of training required for naval observers. It is a large establishment, the result of a 1953 economy telescoping of the Observers' School formerly at St. Merryn, the Naval Air and Intelligence Recognition Centre and the Naval Air

One of the course officers briefs aircrew before take-off.

Part II students are introduced to the Firefly.

TRAINING THE NAVAL AIR OBSERVER . . .

Signal School. Under the title Naval Observer and Air Signal School these now function as an amalgamated concern within the air station under a Commander (O), himself a veteran of the famous raid on the Italian fleet at Taranto. Appropriately, H.M.S. *Seahawk's* present commanding officer, a Naval captain, is also an observer.

The Observer School comprises some six instructional buildings sited near the airfield, each named after a famous aircraft carrier and boasting at the entrance, a picture of the ship, its badge, history and battle honours. They contain well-furnished classrooms, fully equipped demonstration rooms, a briefing room, tactical floor, instructional cinema, and technical and reference libraries. Attached to the school are two training squadrons, one of Hunting Percival Sea Prince "flying classrooms," and one of Fairey Firefly 7s.

The staff includes a senior instructor, who is a lieutenant-commander, upwards of six officers of lieutenant's rank as class instructors, and an instructor lieutenant-commander in charge of the educational side; and there are also instructing officers in meteorology, photography and ordnance. For convenience in class-handling as well as conforming to normal Naval custom, the students are divided into port and starboard watches.

There are two patterns of observer training course. The first is for the Fleet Entry officers who, because of their Naval experience, have certain more advanced subjects included. The second is specially designed to take into account the differing backgrounds of the younger trainees and is thus more flexible. But for both the qualifying standard is rigidly fixed at a high level. A weeding-out process is continuous. In the past year, for example, something like one third of the candidates failed to make the grade. Causes of rejection may vary from inability to reach the technical standard to lack of officer-like qualities.

Lasting 39 weeks, the course is in three equal parts with a short mid-term break in each. And, since the unofficial motto of the Naval Observer branch is "Find, Fix and Strike" the emphasis is primarily on accurate navigation. Courses are staggered three months apart, so that when the Part III students finally march up to receive their wings the Part II men are moving into their places, Part I moves up into Part II, and a fresh batch of candidates arrives at Culdrose to begin Part I. Numbers vary from 16 to 14 in each batch.

When the "new boys" arrive their first few days are occupied in settling in. Upper yardmen, midshipmen and those acting sub-lieutenants who are under the age of 23 live in the gunroom mess, run on traditional warship lines. Acting sub-lieutenants over 23 live in the wardroom.

Part I comprises radar, basic navigation, wireless, and a comprehensive educational brush-up. Lecture periods are of one hour's duration, with two-hour sorties in the flying classrooms. For this part of the course a minimum of 34 hours' day flying is required.

The educational syllabus includes mathematics, physics, electrical theory and electronics; précis writing, for the encouragement of logical development and clarity of thought; essay writing; and Service correspondence. Throughout the course there are periodical pupil lectures during which the students are required to give talks to their fellows on selected subjects, interspersed with debates and quizzes on Service and general topics. In addition, each student keeps a daily journal, similar to those maintained by junior officers in the Fleet, which come in for regular criticism by the instructors.

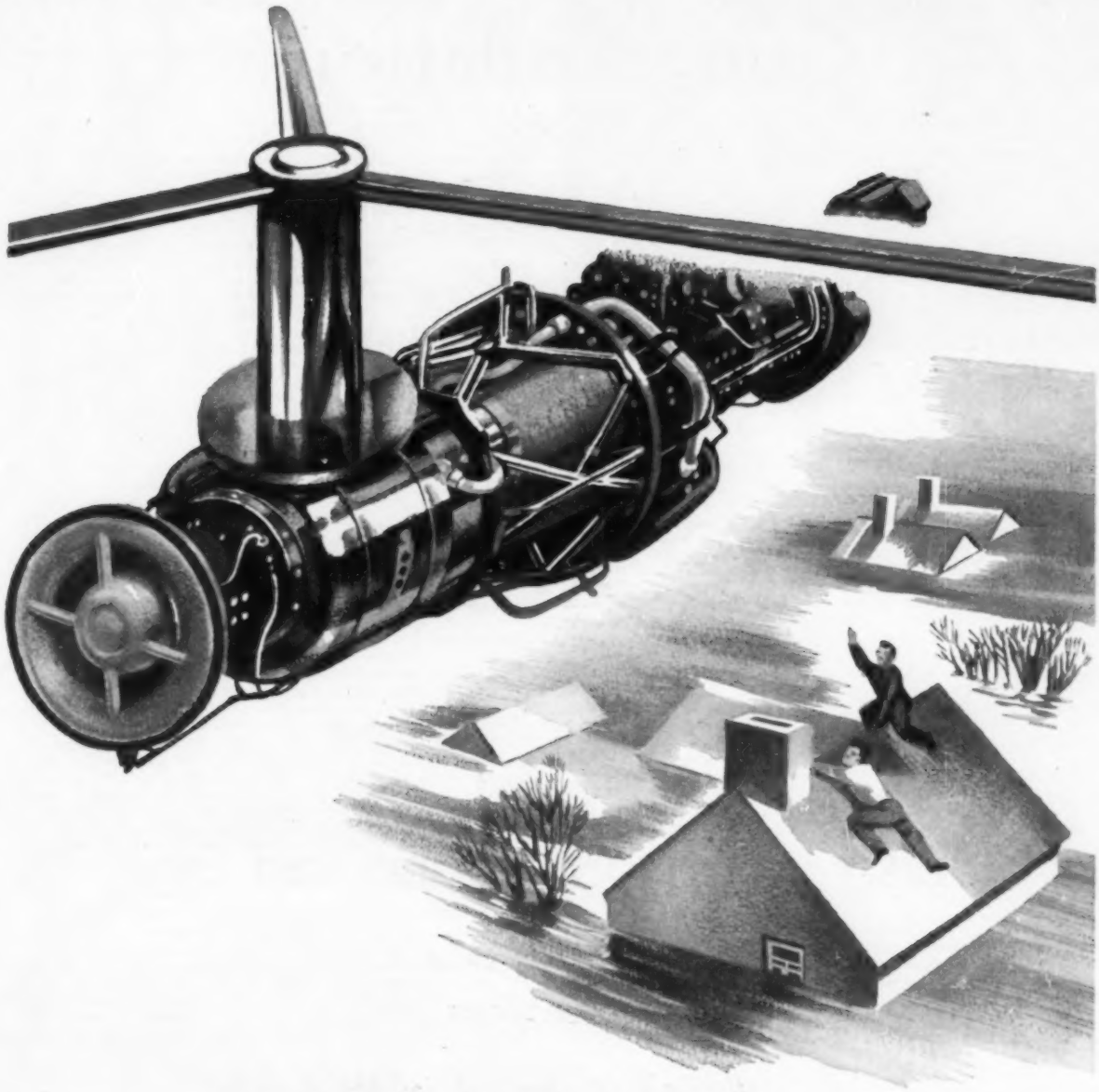
On the technical side the syllabus comprises R/T and W/T procedure, practical signalling, morse, semaphore, flashing and transmitting; W/T equipment, radar equipment, air communications and Naval W/T. Flying starts some two weeks after joining when the students are taken up in the Sea Princes as trainee radar and wireless operators. The Sea Prince can carry up to four students and an instructor.

Along with tuition in airmanship and the elementary principles of navigation, the Part I student is also kept busy on the ground with squad drill and training with the Bren gun, rifle and sword, and with Naval ceremonial. Under the head of ordnance come such subjects as magazines, bombs and dumps, pyrotechnics, depth-charges, mines and torpedoes.

Hanging on the wall of the Commander (O)'s office are a number of racks, each containing a card bearing a photograph of every student together with a brief précis of his personal history and progress. The weeding-out process begins after six weeks, and at the end of Part I a written examination takes place. This is the first big hurdle, for the Commander (O) holds a conference with his course officers on the results, and it decides the fate of the students who have got so far. The attainments and assessments to date of the Part I course members are carefully examined and discussed.

During a recent visit to Culdrose I was invited to sit in on one of these course conferences at which a young National Service entry, the only one in the batch to fail, was adjudged to be below

(Left) Students receiving instruction in radar. (Right) Preparing for a photographic sortie in a Firefly 7.



The heart of a good helicopter

A helicopter engine that works without driving shafts and driving gear—that's the Napier Oryx. It's a 750 gas h.p. turbo-gas-generator, designed for helicopters propelled by jet reaction at the rotor blade tips. It weighs less, it's less complex and it's easier to maintain than conventional helicopter power systems. The Oryx is a step forward—and upward—in helicopter propulsion, and an engine of great importance to helicopter operators.

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CBC 05

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and his crew on their
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TRAINING THE NAVAL AIR OBSERVER . . .

standard. The decision to weed him out was arrived at reluctantly; but, as already stated, the qualifying standard must remain high if the Fleet Air Arm is to continue to get the best material available.

Part II of the course repeats some of the mixture as before, but now the emphasis is more on practical navigation. The syllabus includes navigational maps and charts, navigational instruments and their maintenance and adjustment, radio aids and meteorology, ship and aircraft recognition, photography, air communications and organization, aerodynamics and aero engines, cryptography and fleetwork, and touches basically on maritime warfare.

Flying training is carried out in Firefly Mk 7s, and for this part of the course the students are required to notch up some 40 hours' day and eight hours' night flying. In the air they do navigational exercises, being briefed in the normal way before take-off, and work on interception practices with a frigate from Devonport.

Accidents to training aircraft are rare at Culdrose, but not long ago a Firefly on a training flight with a Part II student and a telegraphist trainee crashed off Land's End. The pilot was killed, and the telegraphist, injured and unable to inflate his dinghy, was in danger of drowning. The student hoisted the injured man into his own dinghy and kept him afloat until rescue arrived. For his gallantry he received the medal of the Royal Humane Society.

Despite the very full technical curriculum the nose of the student observer is not kept continuously to the grindstone. One afternoon a week is given up to organized games. According to season these include rugby soccer, cricket, tennis, athletics, cross-country running, hockey, water polo, fencing, boxing and basketball. Those so inclined may indulge in squash, golf and badminton. There is plenty of boat sailing on the nearby Helford river in the summer months, and Culdrose is fortunate enough to possess a 50-square-metre ocean racing yacht.

Another examination comes along at the end of Part II of the course, and those who pass move on to Part III. The focus is now on the tactical side of their job. The syllabus includes more extensive navigation exercises; scouting and tracking by day and night, and search planning; photo-reconnaissance; H.F. W/T; tactical games; air defence communications; codes and cyphers; and the wider aspects of maritime warfare.

The training aircraft is still the Firefly, and Part III students are required to put in a minimum of 50 hours' day and eight hours' night flying during this final leg of the course. In addition, they are given the opportunity to fly in as many different types of aircraft as possible, including helicopters.

Throughout the course lectures and demonstrations continue on such points of airmanship as air traffic control, safety equipment and Arctic survival. Wet dinghy drill, "abandon aircraft" and helicopter rescues are regularly practised. More pedestrian chores cover divisional officer's duties, Naval accounts, air stores, victualling and administration.

At last the ultimate hurdle is reached, in the shape of final examination. A typical question in the plotting exercise in which a recent passing-out class had to provide a number of answers concerned a convoy shepherded by a carrier in northern waters. It was assumed to be threatened by an enemy surface force. The student was required to take off from a shore base some distance away, find the convoy, search for and pinpoint the enemy, and return to and remain with the carrier.

Presentation of wings by the Flag Officer Aircraft Carriers, Rear-Admiral A. R. Pedder, at R.N.A.S. Culdrose (December 1st, 1955).

On the evening preceding wings day, dinner in the gunroom—at which the whole class is present and the Commander (O) the guest of honour—is pervaded by a slightly strained atmosphere until after the loyal toast has been drunk. Then, to vociferous shouts of "Up, up, higher, higher!" the Commander (O) rises, mounts his chair and, after a tantalizing pause, smilingly announces, "Well, you've all passed!" But for the final order of merit they must wait until the actual presentation.

In each class there is a best student of the course who, in addition to his wings, will receive a prize and have his name engraved on a silver tablet in the hall of the school's administration block. In selecting the individual to receive this distinction the final examination result forms only one of the assessing factors.

When the larger gunroom now being built at Culdrose is opened shortly a new trophy will be given a place of honour. Consisting of an oak plaque mounting a bronze medallion given by Sir Winston Churchill to the late Admiral Sir Dudley Pound, it will be called the "Dudley Pound Trophy." In addition, a trust fund is being instituted from which a "Dudley Pound Prize" will be provided for the best all-rounders.

But although they now sport their wings the newly fledged observers must undergo still more instruction. For this they move on to Eglinton in Northern Ireland for two months' live exercises in Gannets. A short divisional course at Portsmouth and a week's grounding in air intelligence organization wind up the training period, after which they are ready for service with the fleet.

Following the end of World War II, recruiting for the Observer Branch of the Fleet Air Arm came to a standstill. But not for long, for it was soon recognized that the observer has a very definite and important part to play in the flying Navy of today and the future. "Even if we do eventually get pilotless, push-button aircraft," declared a distinguished figure in naval aviation recently, "we shall still need an observer in the back seat." Culdrose is seeing to it that the observer's training is the best possible.

SARO CHIEF TEST PILOT HANDS OVER

AS briefly recorded in our last week's issue, S/L. J. S. Booth, D.F.C., has been appointed chief test pilot of Saunders-Roe, Ltd. The appointment becomes effective on February 1st.

Born in 1919, John Stanley Booth joined the Royal Air Force in 1938 on a short-service commission, and served with distinction in France in 1940, where he was wounded and awarded the D.F.C. From 1941 until the end of 1943 he was instructing in Canada. Then, for two years, he flew night fighters and intruder operations with 100 Group, Bomber Command, during which time he was awarded a Bar to his D.F.C. Towards the end of 1944 he was posted to "A" Squadron at Boscombe Down, and in 1945 was in the third course at the Empire Test Pilots' School.

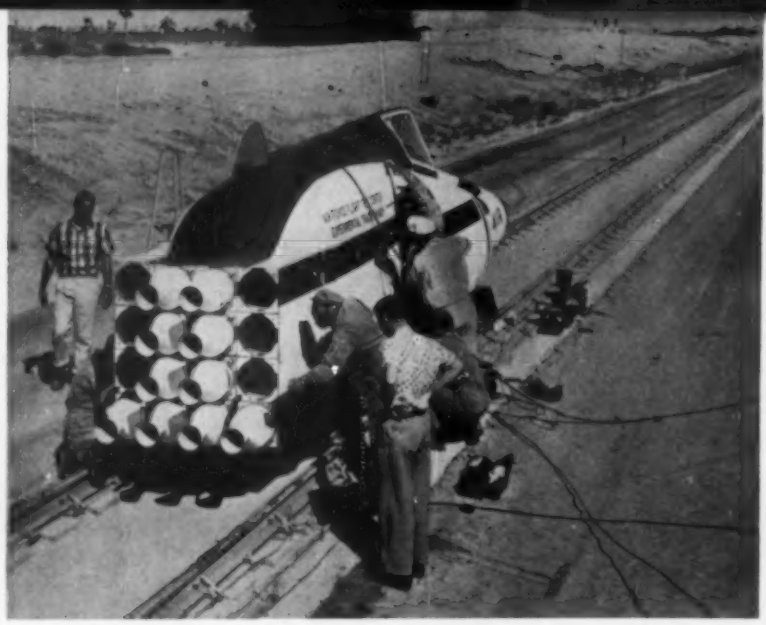
On demobilization, he became a test pilot with Power Jets, Ltd., then went to Short Bros. at Rochester, later moving to Belfast. During the next two years he was responsible for most of the test flying on the Sturgeon, did much work on the development of the Solent, and flew the civil version of the Shetland.

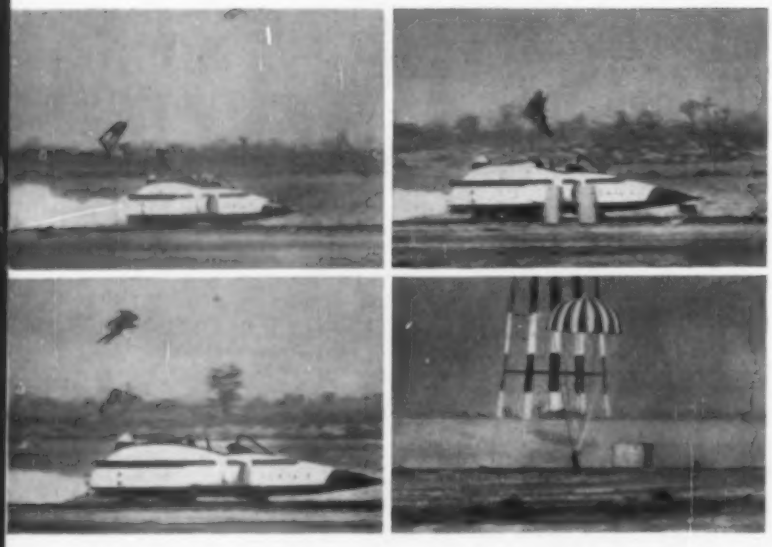
John Booth went to Saunders-Roe as deputy chief test pilot in February 1949. He did some of the test flying on the SR/A.1 and also shared with Mr. Geoffrey Tyson the development flying of the Princess. He has logged over 3,500 hours on more than 90 different types. One of the earliest pilots to fly jet aircraft, in his new post he is likely to be testing an extremely advanced machine—the S.R.53 mixed-power fighter.

S/L. J. S. Booth (left) and Mr. G. A. V. Tyson.

EJECTION RESEARCH

—in U.S.A.: High-speed Tests with Rocket-propelled Sled



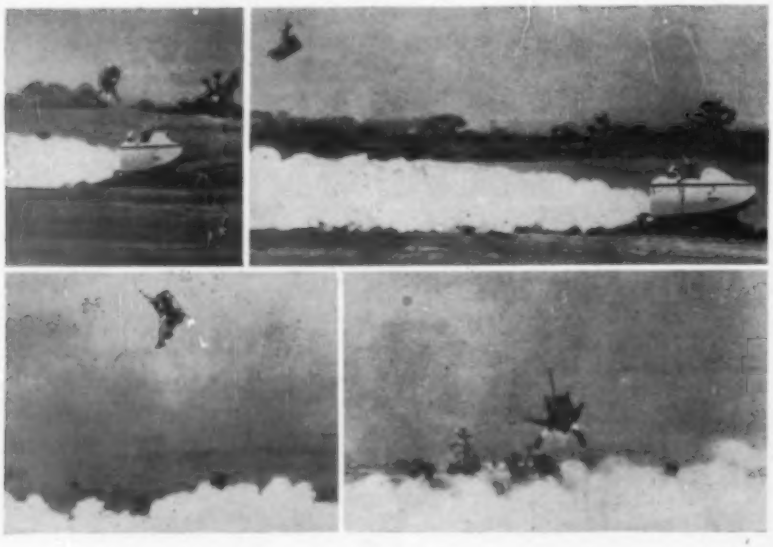


THE experience of George Smith, North American test pilot, who survived an ejection at supersonic speed and low altitude, though not without considerable injury [Flight, December 2nd, 1955] has focused official attention in America on the problems of providing adequate protection for escape from supersonic aircraft. Concurrently, also, there have been programmes of research into methods of allowing ejection at ground level and low speed, and for ejection in the same conditions from V.T.O. aircraft. In America it is not uncommon for the manufacturer of the aircraft to produce the ejector seat as well.

For a wide variety of purposes, considerable use has been made of rocket-propelled sleds capable of attaining speeds up to, and even in excess of, Mach 1, and these have now been brought into use for ejector-seat research. Above is shown a Convair F-102 cockpit mock-up with which ejection trials have been made. Boosted by ten Jato units, the sled reaches the required speed in a very short distance.

Four frames (left) from a high-speed ciné-camera record of a ground-level ejection show the dummy, clothed in a partial-pressure suit, being hurled clear after the hood has been jettisoned. The fourth frame shows the striped parachute fully open, and the dummy descending vertically, close to the tower which can be seen in the background of the picture above. No details are given of the type of seat used, but it appears to have no face blind. The constant position of the dummy's legs seems to indicate, however, that some form of leg-restraint is fitted.

The lower series of pictures, again from a high speed camera record, show an experiment which was carried out to assess the forces imposed after ejection on a dummy—which in this instance had been so constructed that its characteristics of size, shape and weight matched those of George Smith. Here, of course, there was neither leg-restraint nor face blind, and the "pilot" was ejected in a very poor position. The sled was at the time travelling at a speed equivalent to that of the original ejection, i.e., between 700 m.p.h. and 750 m.p.h. It appears that an observer wearing the latest protective helmet was riding in the mock-up F-100 cockpit immediately behind the dummy. No parachute was used, and the dummy was destroyed on landing, but information on stresses was transmitted to ground receivers by a telemetering radio inside the dummy's chest. The wild tumbling of the unstabilized seat and violent flailing of the limbs can be clearly seen.



The heading photograph shows the rocket sled, and the upper four ciné frames an experimental ejection. The other four high-speed pictures are of the tests in which George Smith's ejection experience was reproduced at 700-750 m.p.h.

FOLLAND EJECTOR SEAT

"Dumbo" Willans Makes First Live Test

A SUCCESSFUL live ejection has now been made with the Folland lightweight automatic ejector seat. The test took place over Netheravon airfield on December 21st, when Maj. T. W. ("Dumbo") Willans ejected from the rear cockpit of a modified Meteor 7 flown by Folland test pilot Dick Whittington. The ejection was made at an airspeed of 150 kt at 5,000ft, with a wind of 15 kt. The sky over the dropping zone was almost obscured by broken cloud and few, if any observers on the ground saw the actual ejection. All around were dark, heavy cloud-banks. The bang was heard and watchers caught sight of the open parachute at intervals before Willans finally emerged from the clouds. He landed well and truly on the airfield, and the seat fell some distance away.

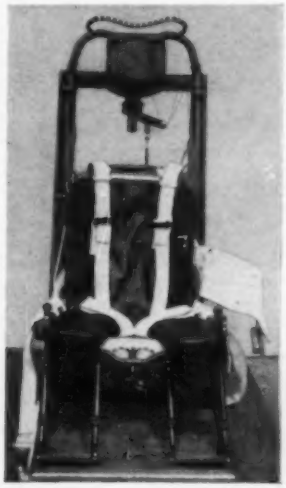
The Folland seat has a combined seat and parachute harness specially developed by G.Q. Parachute Co., Ltd., and the pilot wears the latest G.Q. 24ft lightweight canopy. About one second after ejection, the man is released from the seat; and, though both then have approximately the same drag, the seat is lighter and falls away behind him. Immediately after this, a small stabilizing parachute emerges from the main pack to steady the man in free fall and an emergency oxygen bottle in the pack is turned on. As soon as 10,000ft is reached in stabilized fall, a barometric device releases the main canopy. In the Netheravon test, of course, when the ejection was made below 10,000ft, the parachute was deployed straight away. A Folland leg-restraint has been designed but was not fitted on this occasion. Firing is by pulling a handle above the head rest and drawing a protective blind over the face. An alternative firing handle is located on the front of the seat pan. During the test the seat separated after one second and the parachute was set to open three seconds later in order to allow clear observation of the working of the various elements.

Maj. Willans.

The Folland seat has been developed under a M.o.S. contract and follows the general engineering principles of the Swedish Saab seat which has been in use by the Swedish Air Force since July 1943—and which, the company states, is believed to be the first of all modern ejector seats fired by an explosive charge. With an 8-lb supporting structure attached to the aircraft, the new seat weighs only 47 lb. It is specified as standard equipment for the Folland Gnat.

Major Willans is a well known parachutist and is British representative on the parachuting committee of the Fédération Aéronautique Internationale, technical sales executive of the G.Q. Parachute Co., Ltd., and chief instructor of the civilian parachute school at Denham, Bucks.

The light, clean design of the Folland seat is apparent in these three photographs, one of which shows the face blind being grasped for firing.



CANADIAN BRISTOL REORGANIZATION

SINCE January 1st, in accordance with the preliminary announcement made some four months ago, the business of the Bristol Aeroplane Co., Ltd., has been known under its three new titles—Bristol Aircraft, Ltd., Bristol Aero-Engines, Ltd., and Bristol Cars, Ltd.

On New Year's day it was announced that the Bristol Canadian interests are undergoing a comparable reorganization.

Hitherto, the company's affairs in Canada have been handled by two subsidiaries of the parent company—one controlling the original engine repair bases in Montreal and Vancouver and acting as the general sales organization, the other being responsible for the MacDonald Brothers' plant at Winnipeg.

Under the re-arrangement now taking effect, the Montreal, Vancouver and Winnipeg centres will be controlled by one company, the Bristol Aeroplane Company of Canada (1956) Ltd., which will be a subsidiary of the parent company at Bristol. The offices of the new company will be at Montreal, and the directors will be Sir Reginald Verdon Smith (chairman), R. J. Reynolds (president), A. Cdre. F. R. Banks, A.V-M. A. L. James, Col. P. P. Hutchinson, R. G. B. Dickson, W. R. C. Patrick and J. N. Baird.

The Boards of the three operating companies will be as follows:

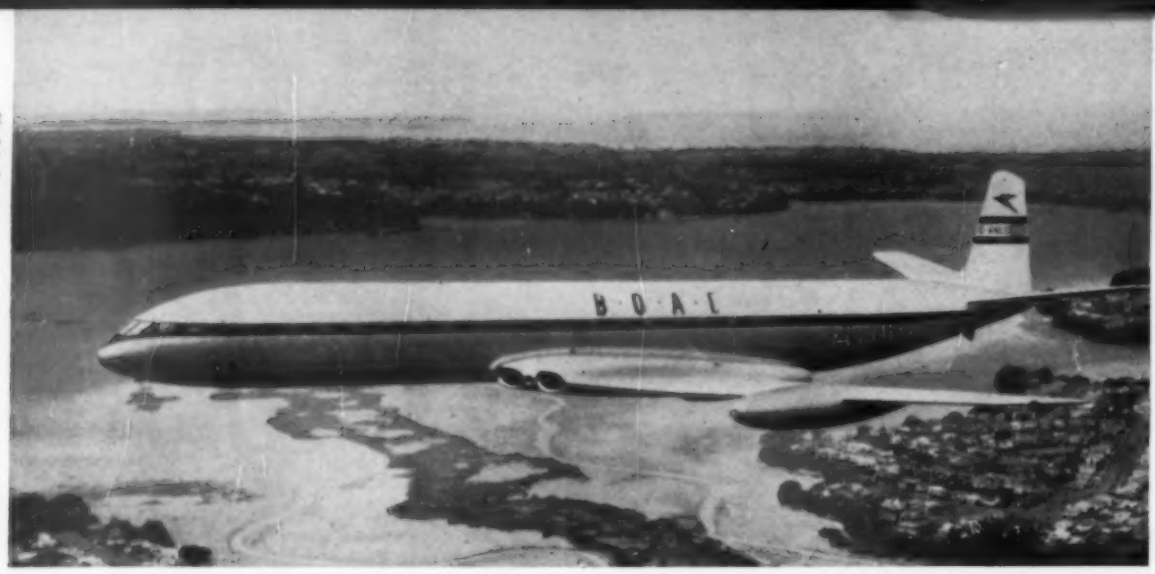
Bristol Aero-Engines, Ltd. (Montreal).—Sir Reginald Verdon Smith (chairman), R. J. Reynolds (president), A.V-M. A. L. James (general manager), J. A. Limoges, D. R. McMaster.

Bristol Aero Engines (Western), Ltd. (Vancouver).—Sir Reginald Verdon Smith (chairman), R. J. Reynolds (president), J. H. Holt (general manager), W. R. C. Patrick, W. H. K. Edmonds.

Bristol Aircraft (Western), Ltd. (Winnipeg).—Sir Reginald Verdon Smith (chairman), R. J. Reynolds (president), W. S. Haggett (general manager), R. G. B. Dickson, G. Lawson.

The story of Bristol activities in Canada began over 25 years ago, when the British company licensed Canadian Wright to overhaul and service Bristol engines in North America. In 1950 an office was opened in Montreal (the Bristol Aeroplane Co. of Canada, Ltd.) and the Wright operations were supplemented by a new Bristol engine overhaul plant in Vancouver. In 1951 the company purchased Canadian Wright and, the following year, constructed a large, modern engine overhaul and test plant in Montreal North.

The acquisition of the business of MacDonald Brothers Aircraft, Ltd., in 1954 expanded the Company's facilities to include manufacture of aero engine parts, and other aircraft components.



The Comet 3 on course for Whenuapai Airport, Auckland, flies over the upper reaches of New Zealand's big seaport.

THE COMET 3's TOUR

30,000-mile Round-the-World Voyage in 67 Hours' Flying Time

AT 10.51 hr G.M.T. on Wednesday, December 28th, the de Havilland Comet 3 landed at London Airport at the end of its 30,000-mile round-the-world proving flight. The aircraft had flown the 3,250 miles from Montreal in 6 hr 18 min at an average speed of 515 m.p.h. Summing up the tour, chief test pilot John Cunningham said: "Apart from our delay in Montreal [caused by the detachment of the extension jet-pipe from the starboard inner engine a few minutes out from Montreal on December 22nd], which we put right from our own resources, we had no delay whatsoever throughout the trip, and the general reliability and easy maintenance of the aircraft and engines were outstanding." Demonstration flights had been given at Sydney, Melbourne, Auckland, Honolulu, Vancouver and Montreal, carrying some 50 people on each flight. Among the operators who sampled the aircraft were Australian National Airways, Trans-Australia Airlines, Qantas, Canadian Pacific Airlines, Tasman Empire Airways, and Trans-Canada Air Lines. "People were particularly impressed," said Cunningham, "by the airport behaviour of the Comet—especially its short take-off and landing."

At the conclusion of the flight, the de Havilland Company acknowledged the help given by B.O.A.C.: "The company was delighted to fly in B.O.A.C. colours and greatly appreciated the decision of the Corporation to send Capt. Peter Cane to accompany the aircraft, as a member of the crew, throughout the tour." The Comet was flown strictly in accordance with normal jet airliner procedure and, as far as Montreal, no departure had to be made from a schedule drawn up before leaving Hatfield. The original flight plan was achieved within very close limits of time and fuel consumption. In this respect the primary aim of the tour—to make a practical assessment of the Comet 4's commercial capabilities—was fulfilled; and there is no doubt that the eager de Havilland effort to establish the Comet in the world market could not have been more confidently demonstrated. The tour is summarized in the accompanying table.

The de Havilland company states that further Comet 3 flights are envisaged. These may include a tour of North and South America later this year.

TIMES, DISTANCES AND SPEEDS

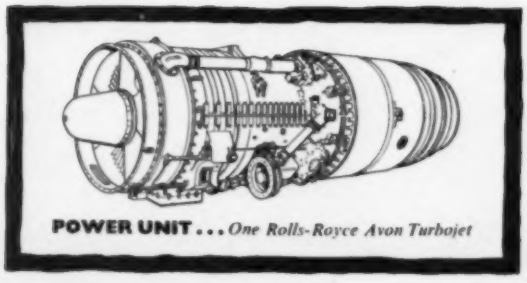
Dec.	Stages	Dep.* (G.M.T.)	Arr.* (G.M.T.)	Time (hr, min)	Cumu. time (hr, min)	Dist. (st. mi.)	Cumu. dist. (st. mi.)	Speed (m.p.h.)
2	Hatfield-Cairo ...	10.54	15.53	4.59	—	2,346	—	471
3	Cairo-Bombay ...	06.08	11.19	5.11	10.10	2,710	5,056	523
3	Bombay-Singapore	13.07	18.25	5.18	15.28	2,456	7,512	463
3-4	Singapore-Darwin	20.15	00.53	4.38	20.06	2,090	9,602	451
4	Darwin-Sydney ...	02.25	07.12	4.47	24.53	1,968	11,570	411
6	Sydney-Melbourne	05.09	07.00	1.51	26.44	440	12,010	238
8-9	Melbourne-Perth ...	23.00	04.40	5.40	32.24	1,689	13,699	298
9	Perth-Sydney ...	07.10	11.32	4.22	36.46	2,047	15,746	469
12	Sydney-Auckland ...	21.00	23.40	2.40	39.26	1,336	17,082	501
13	Auckland-Fiji ...	03.13	06.07	2.54	42.20	1,326	18,408	457
13-14	Fiji-Honolulu ...	19.50	02.46	6.56	49.16	3,178	21,586	458
16	Honolulu-Vancouver	15.59	21.47	5.48	55.04	2,707	24,293	467
18	Vancouver-Toronto	15.43	19.55	4.12	59.16	2,078	26,371	495
20	Toronto-Montreal	13.39	14.48	1.09	60.25	320	26,691	278
28	Montreal-London	04.33	10.51	6.18	66.43	3,243	29,934	515

* Airport timing procedures vary: most of the times quoted are chock-to-chock, but some may be take-off to touch-down.

Sir Geoffrey de Havilland and Sir Miles Thomas were at London Airport on December 28th to welcome the crew of the Comet 3 home.

(Right) Harold Davies, crew-member of the Comet 3 in charge of inspection, found nothing to snag at Hawaii, where the Comet stayed for two days.

THE *FAIREY* DELTA 2



POWER UNIT . . . *One Rolls-Royce Avon Turbojet*

How to go faster: the basic unchanging problem of aircraft design. Mach 1 is no longer the target; but higher Mach numbers present entirely new obstacles. The Fairey Delta 2 will play a part in the investigation and solution of these problems at newly-attainable speeds, showing the way to aircraft for the future needs of N.A.T.O. and the Western world.

THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

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The Nord 2501 Noratlas transport of the French Air Force is seen with the new, extended, dorsal fins which are to be retrospective modifications on this type. As recorded on this page, two Noratlas are due to be demonstrated in Sydney during March and April this year. The helicopter is the latest version of the S.E.3130 Alouette, with the now-complete cockpit enclosure.

AIRCRAFT INTELLIGENCE

U.S.A.

Boeing B-52D. This designation applies to the Wichita-built version of the Stratofortress. Like the "C" sub-series, it weighs over 400,000 lb and carries larger drop tanks than earlier machines of the series. Like the "A", however, it is strictly a bomber, whereas the "C" is capable of multiple strategic rôles, outlined by Boeing as "conventional and nuclear weapons delivery and photographic reconnaissance".

Lippisch Research Aircraft. It is reported from Cedar Rapids that Dr. A. M. Lippisch, father of the modern delta configuration, is working on an experimental machine described as "in effect a flying fuselage propelled by an internal lift-inducing propulsion system". Vertical ascent and descent will be possible without the use of airscrews. The U.S. Navy is said to be interested in the project.

Cessna 172. This new four-seater development by Cessna has a nosewheel undercarriage, is powered by a 145 h.p. Continental engine and sells for $8,750 (£3,125), fly-away Wichita.

Beechcraft Model 73. A photograph of this new and attractive tandem-seat jet trainer appears on an earlier page. The makers say that it is ready to be delivered "off the shelf" to air forces throughout the free world, and it bears the same relationship to the T-34 Mentor as does our own Hunting Percival Jet Provost to the Provost. The engine is a Continental J69-T-9, which is estimated to give a maximum speed of 253 kt at 15,000ft; at 4,520 lb max. wt. The stalling speed should be 60 kt.

France

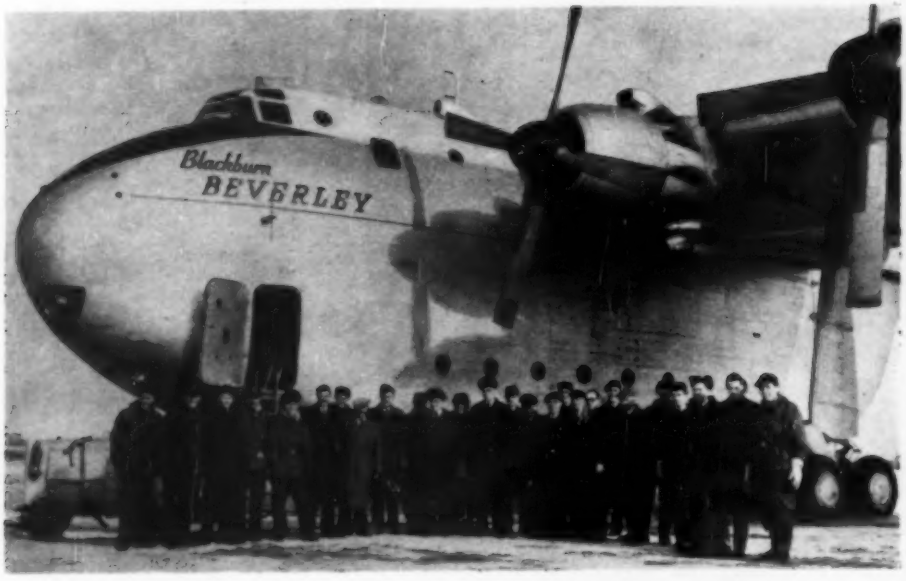
Sydney Demonstration Tour. Notification was given in our issue of November 11th of French participation in the International Fair to be held in Sydney from March 19th to April 3rd this year. The list of participating aircraft is now given as: two Nord 2501 Noratlas, one of them transporting an S.O.1221 Djinn helicopter, and a Max Holste 1521 Broussard. This list, however, is not necessarily complete. Stops are likely to be made at Ankara, New Delhi, Djakarta, Melbourne, Sydney and Pnom Penh.

Nord 1203 *Norécrin.* This new development of the Norécrin, powered by a 160 h.p. S.N.E.C.M.A. engine, is now at the Brétigny flight-test centre. It is extensively soundproofed and has a new type of silencer. Cruising speed has risen in this version from 130 m.p.h. to 146 m.p.h. and the all-up weight is 2,540 lb. (Earlier versions were cleared at the same weight figure, so no structural modification has been necessary for the installation of the new engine in place of the 140 h.p. unit formerly fitted.)

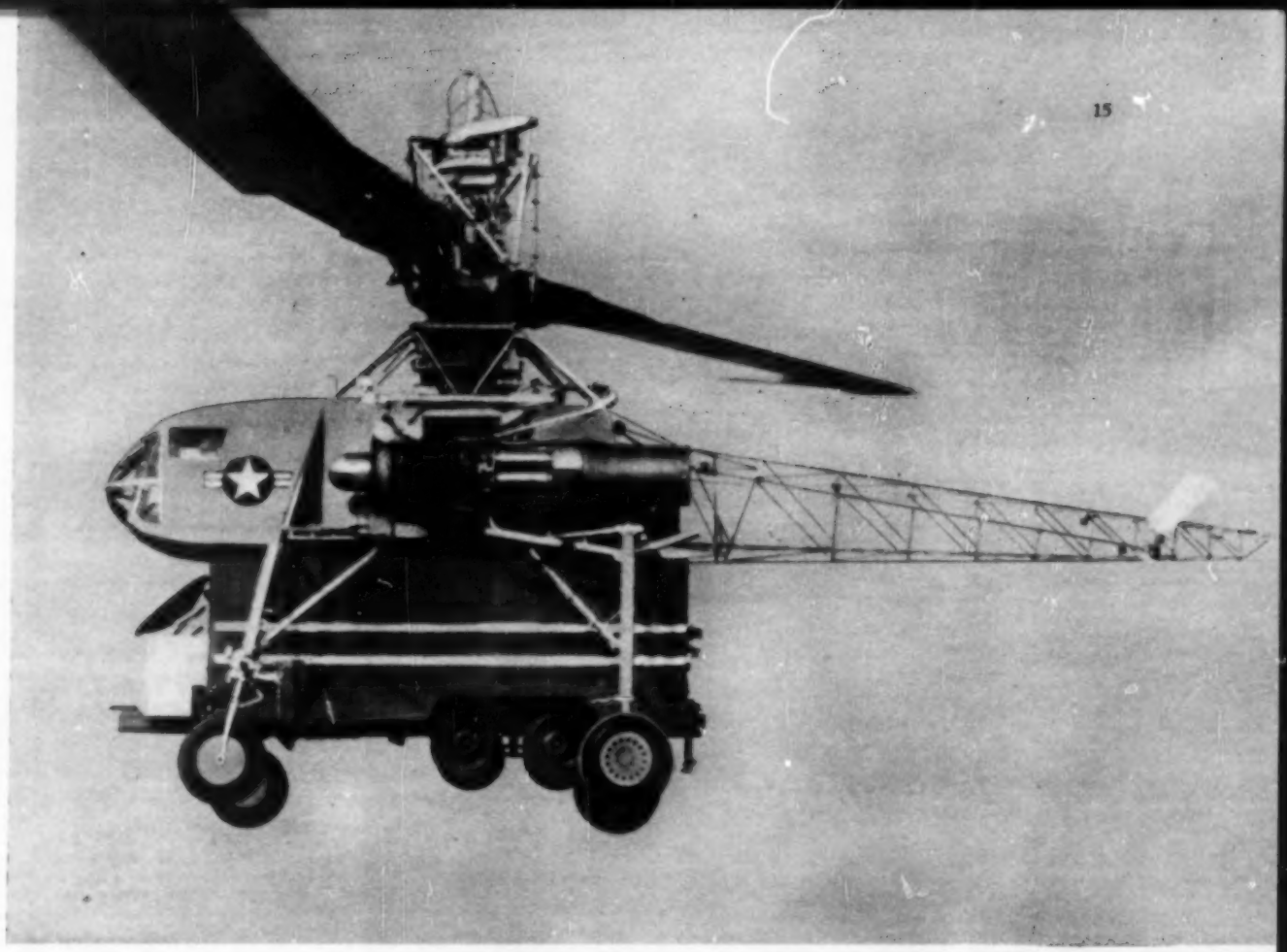
S.E. 3130 *Alouette.* French Air Force, Army and Navy orders for this helicopter (a recent picture of which appears on this page) have now reached 180. Among the first civil customers to have placed an order is the French Electric Power Authority.

FAIRCHILD C-123B PROVIDER
(Two Pratt and Whitney R-2800-99W)

Span	110ft
Length	75ft 9in



A SPREAD OF GIANTS



AMERICA'S most capacious freighter (excluding the "one-off" XC-99, transport version of the B-36) is the Douglas C-124 Globemaster. At upper left one of these monsters is taking aboard the main hull section of a Piasecki H-21 helicopter.

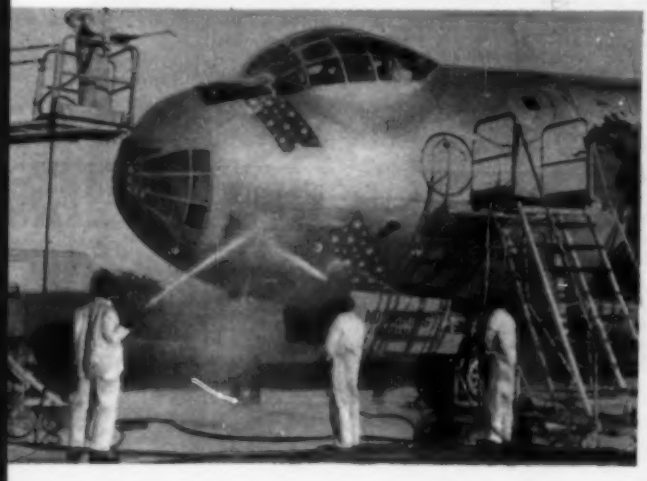
Britain's nearest counterpart is the Blackburn Beverley C.1, a specimen of which is seen, with its delivery crew, in the second picture, having crossed the Atlantic for winterization tests by the R.C.A.F.

The assembly at lower left is celebrating the rolling out of the first Boeing B-52D Stratofortress (the B-52 is the world's largest jet bomber) from the Wichita division of the Boeing Airplane Company. Close by is a B-47E, completed almost simultaneously.

The mammoth helicopter which dominates this page is the Hughes XH-17, seen lifting a record single load in the form of a 7,800-lb trailer van.

Immediately below, specially clothed workmen wash down a radioactive Convair B-36 bomber—still the world's largest.

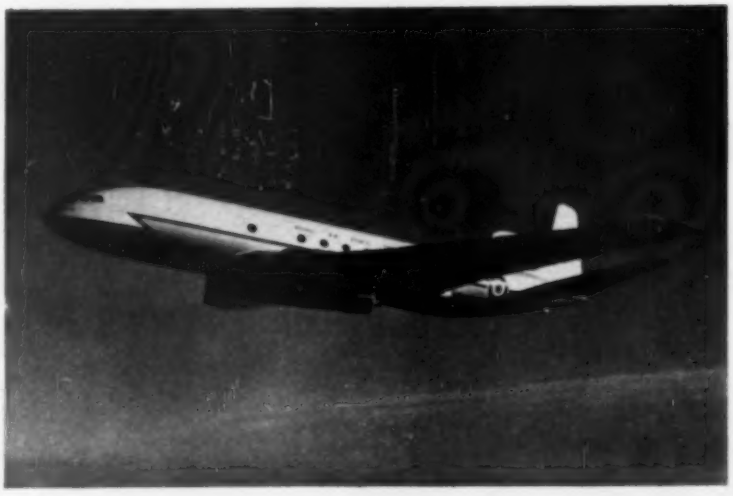
Last is the world's mightiest aircraft carrier, the U.S.S. *Forrestal* (CVA-59), moving away from her berth at Newport News. Her length is 1,040ft, her beam 248ft, and she will have a complement of 3,500.



COMET IN THE ASCENDANT

THE magic of two names—Comet and Hawaii—is perfectly distilled in the picture above of the flower-garlanded de Havilland Comet 3 a few minutes after its arrival at the airport of Honolulu. It captures something of the spirit of an historic round-the-world flight which, fast but unflustered, was marked at every port of call by hospitality never before accorded to an airliner.

The picture on the right provides a reminder that the Comet in its military role will soon be a common sight wherever R.A.F. Transport Command flies. It shows the newly styled Comet 2, the second production aircraft (formerly G-AMXB, now XK669), which is soon to go to Boscombe Down for acceptance trials before delivery to No. 216 Squadron at Lyneham. Like its sister aircraft now being completed by de Havilland at Hatfield and Chester, it embodies the re-fashioned structure to permit operation at full cabin pressure. Engines are Rolls-Royce Avon 504s of 7,300 lb thrust each, and the aircraft has a full civil Certificate of Airworthiness.



A complete Sapphire power-plant ready for installation in what can be deduced as a Gloster Javelin. Large numbers of generally similar engines, all tested at well over 8,000 lb thrust, have been delivered.

ARMSTRONG SIDDELEY SAPPHIRE

An Outstandingly Powerful and Efficient Single-shaft Turbojet

ALTHOUGH in itself an engine of particularly straightforward design the Armstrong Siddeley Sapphire turbojet has a history which is threaded with paradoxes. Designed by one famous British company it was entirely taken over, developed and put into production by another. A British engine, it is nevertheless flying in much greater numbers in the U.S.A., and it went into service in that country before it did in its own land. And, although it combines high thrust, competitive specific consumption and easy handling to a marked degree, it is one of the simplest large gas turbines ever designed.

Before writing of the Sapphire itself an outline should be given of the work which led up to its original design. The Metropolitan-Vickers Electrical Co., Ltd., were the first non-German company to work on axial gas turbines for aircraft propulsion. On behalf of, and in co-operation with, the Royal Aircraft Establishment, this Manchester firm began research on axial-flow compressors in 1937, and the following year started bench tests on the first of a series of such units.

In 1940 the R.A.E. invited Metrovick to build a turbojet to a basic design which had been formulated at Farnborough by a team working under Hayne Constant, the present director of the N.G.T.E. The compressor used was of an R.A.E. design which had been given the appellation "Freda," and the resulting engine was accordingly designated Metropolitan-Vickers F.1. Various forms of F.1 were built, the first being put on the bed late in 1941. Later F.1s successfully completed special-category flight-clearance tests in 1942 and the first flight took place on June 29th, 1943, the turbojet being mounted in the bomb bay of an Avro Lancaster. This was the first non-German axial engine to fly.

Following the F.1 came the F.2, also built in a number of versions and one of the most advanced turbojets of its day. The original F.2/1 was rated at 1,800 lb thrust, and two of the first flight engines were flown in Meteor DG 204/G on November 13th, 1943, this being the first aircraft outside Germany actually to be propelled by axial gas turbines. Progressive development brought forth the 3,500 lb-thrust F.2/4 which first ran in 1945 (later named Beryl, in conformity with the Metrovick policy of taking the names of precious stones), the F.3 ducted fan turbojet and the F.5 turbofan. Descriptions of these engines were published in our issues dated April 25th and November 28th, 1946.

While long-term research and development was going ahead with these, and other, units, the company began to investigate a high-thrust turbojet designated F.9. Throughout 1945 study of the F.9 project progressed, the work being purely of a research nature without Government support. In the following February, however, the company received a Ministry of Supply project contract, which was backed up by an order for prototypes in May 1946. The F.9 design study was thus transformed into the Sapphire turbojet, with the first Ministry rating MVSa.1. The first prototype ran in 1947.

The small drawing overleaf depicts the MVSa.1 as it was in that year. As might be expected it was a singularly straightforward engine, with a 13-stage compressor, an annular combustion chamber and a two-stage turbine. Yet each component was significantly more advanced than current practice at that time. It is obvious that the pressure ratio was considerably higher than that of contemporary axial units, and the overall design of the combustion chamber—employing the typical Metrovick system of low-dispersion burners injecting upstream into a primary airflow—was also inherently ahead of the can-type chambers of most gas turbines of 10 years ago.

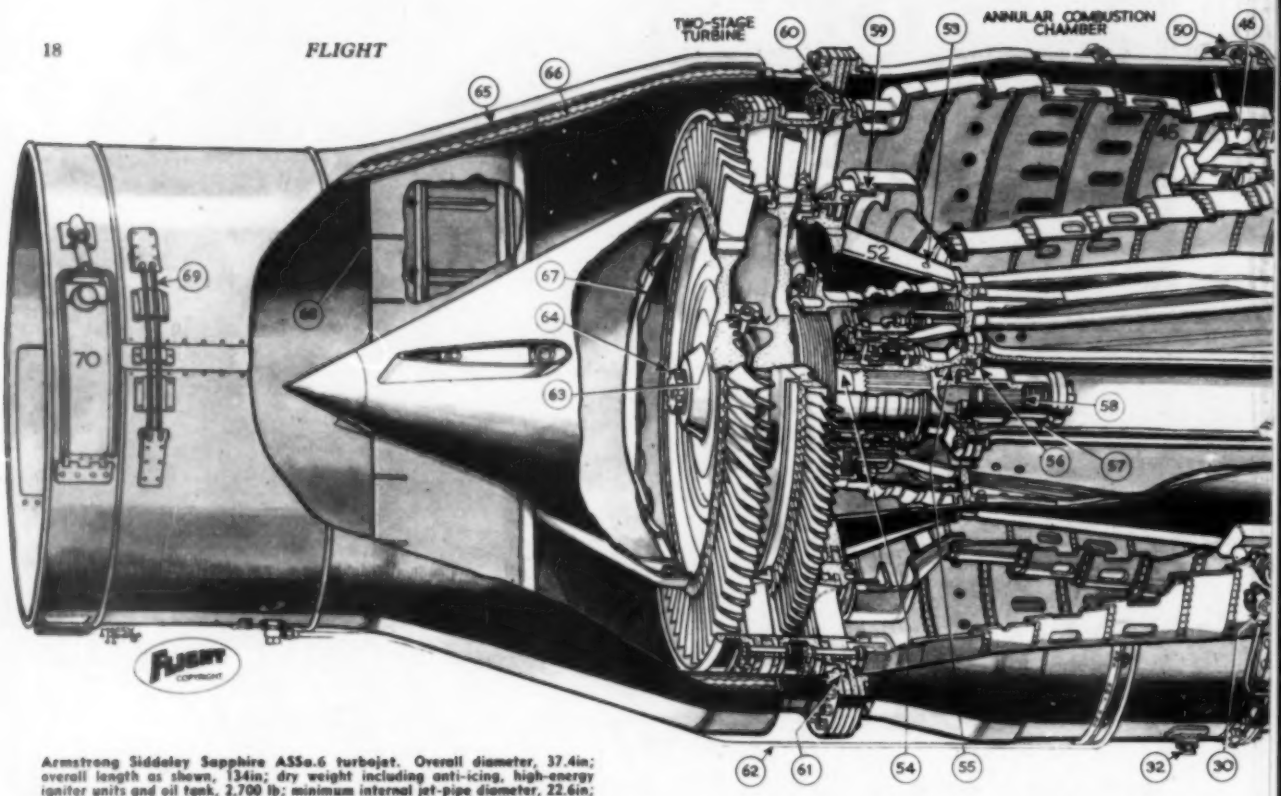
In spite of its advanced conception the Sapphire ran relatively well from the outset. This reflects Metrovick's extensive axial experience and ability, and it could have placed the company in a very strong position in the aircraft gas-turbine field. Nevertheless the company decided in 1947 to cease their association with aero engines entirely.

It would have been tragic had so promising an engine as the Sapphire been allowed to fade away; furthermore it was—at that time—the policy of the Engine Research and Development branch of the M.o.S. to sponsor two designs of engine to each major requirement, largely as an insurance. Rather than go through all the uncertainties of ordering a completely new engine the M.o.S. decided to find a company capable of taking over the Sapphire as a "going concern" so that, as an alternative to the Rolls-Royce Avon, it would remain a possible future engine for British military aircraft then projected.

The obvious choice for a company to take over the Sapphire was Armstrong Siddeley Motors, Ltd., who were the only other firm in Britain with axial experience anything like comparable to that of Metrovick, and who had the development capacity available. Late in 1947, therefore, they agreed to accept responsibility for all future development of the new turbojet. At the Ministry, the designation MVSa.1 changed to ASSa.1, and the Coventry company actually took over work at the beginning of 1948.

As already stated, the original F.9 project was intended primarily as a research tool, and the Metrovick programme had not been aimed directly at producing an engine capable of entering military service. Nevertheless there is no doubt that it was, when taken over by Armstrong Siddeley, one of the most promising large turbojets in the world. It had already shown that it could develop something over 6,500 lb thrust with a low specific fuel consumption and with remarkably easy and trouble-free running.

Unfortunately it was impossible to avoid losing many months during the change-over, and bench running did not start at Armstrong Siddeley until October 1948. Nevertheless the engine's new masters had not been idle. By that month drawings had been issued for a considerably revised and cleaned-up version, designated ASSa.2, which, it was intended, would form a starting point for the development of future, operational versions. In the original F.9 the compressor comprised discs welded together at their peripheries (as shown in detail on p. 20), each disc having



Armstrong Siddeley Sapphire ASSa.6 turbojet. Overall diameter, 37.4in; overall length as shown, 134in; dry weight including anti-icing, high-energy igniter units and oil tank, 2,700 lb; minimum internal jet-pipe diameter, 22.6in; rated thrust, 8,000 lb at 8,600 r.p.m. with specific fuel consumption of 0.9; cruising s.f.c., 0.85. Note: the similiar ASSa.12 is rated at 8,500 lb thrust.

ARMSTRONG SIDDELEY SAPPHIRE...

dove-tail slots into which the rotor blades were driven and sealed by Marco resin. This welded-drum form of compressor was retained in the Sa.2, but variable inlet guide vanes were incorporated, the exhaust cone was modified and slight alterations were made to the combustion system.

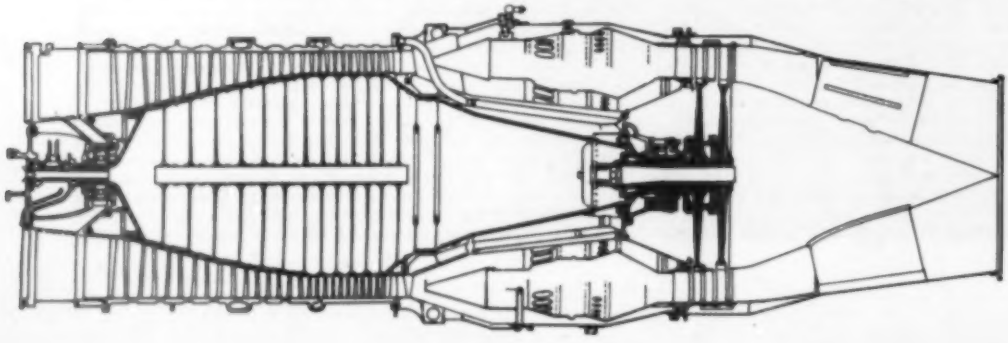
Meanwhile, in October 1948—the month in which running started at Coventry—the basic Sa.1 passed its first M.o.S. acceptance test, and running with these engines continued into 1949. In December, 1949, the Sa.2 also completed its acceptance test, at its design rating of 7,380 lb, and this is believed to have been a record at this time (the much-larger General Electric J53 was not at a comparable state of development). The running of the Sa.2 was sufficiently encouraging for a flight-clearance test to be attempted, and achieved at the first try. Two Sa.2s were then mounted in the Lancastrian test bed VM 733 and this aircraft flew in January 1950. The following August a pair of Sa.2s were flown in Meteor 8 test bed WA 820, and on August 31st, 1951, this aircraft, flown by F/L. R. B. Prickett, reached an altitude of 12,000m (39,370ft) in a time of 3 min 7 sec from a standing start—a record which still stands. The third Sapphire-powered aircraft was a Handley Page Hastings, in which two Sa.2s were fitted, chiefly to provide the firm responsible for the Victor with Sapphire experience. This aircraft was first flown by S/L. H. G. Hazleden on November 13th, 1950.

Meanwhile, Armstrong Siddeley had been carrying out a considerable amount of redesign on the Sapphire, and the resulting ASSa.3 marked the first complete departure from Metrovick tradition and practice. There were three major alterations: the adoption of a vaporizing type of combustion chamber, the addition of a centre bearing and redesign of the main rotating assembly to bring it more into line with previous Armstrong Siddeley practice.

The new compressor rotor was built up from thin discs, two to each stage, with light-alloy blades riveted through each adjacent pair of discs. The discs were mounted on a drum driven by a conventional hollow shaft from the turbine. A spherical bearing was incorporated in the drive immediately to the rear of the centre bearing, the latter being a roller assembly carrying no axial load. This completely different arrangement for the main rotating assembly was subjected to extensive rig testing and was found to offer considerably more promise, at a lighter weight, than did the original, drum-like rotor, hung between two bearings.

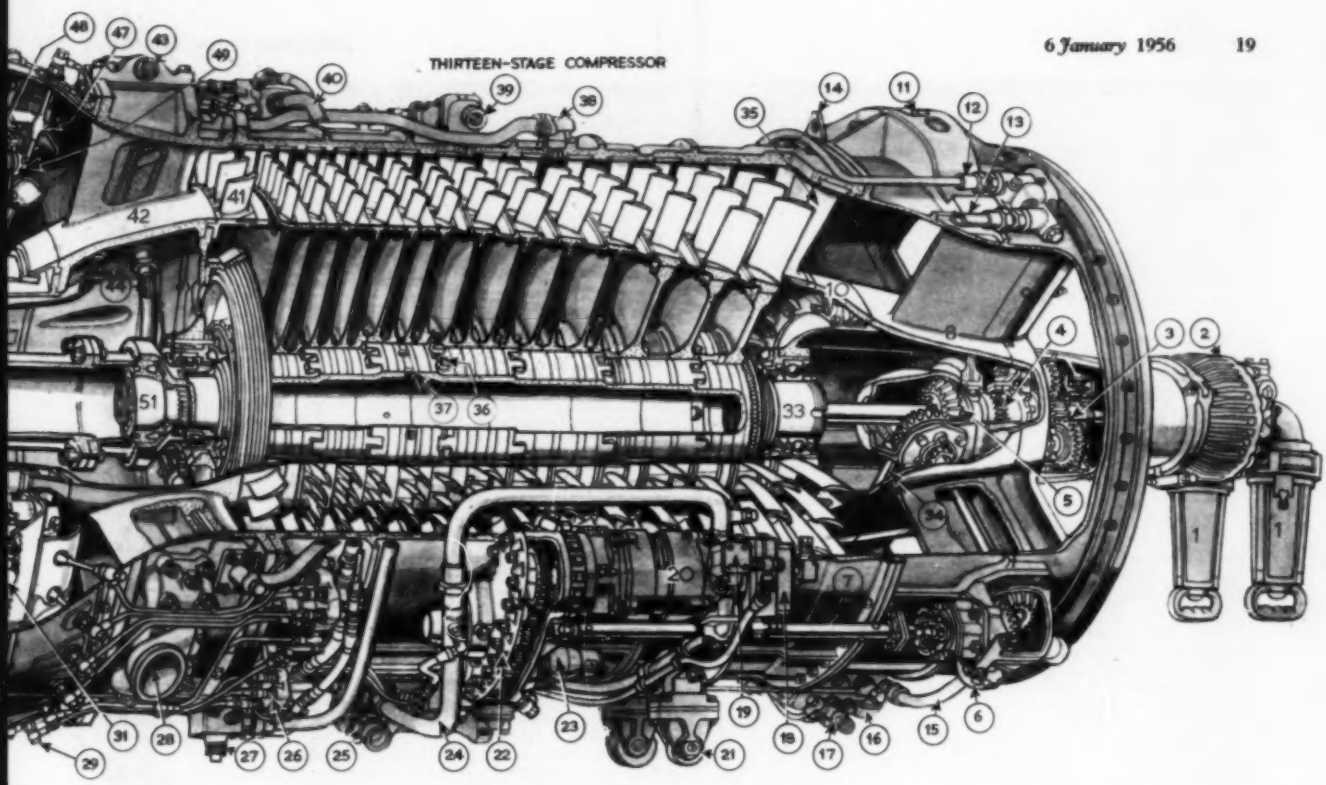
Initially the Sa.3 had a slightly lower rating than the Sa.2, the Sa.3 starting off some 300 lb under the 7,500 lb thrust eventually reached by the earlier unit. Nevertheless it was clearly a better engine mechanically, and it passed its acceptance test in April 1950, and a full type test only three months later, the rated performance being 7,220 lb thrust with an s.f.c. of 0.916. These excellent figures are a tribute both to the Metrovick design team and to the engineering ability of Armstrong Siddeley. At this stage the latter company could confidently foresee a bright future for the sparkling Sapphire, which was not only an outstanding performer but was singularly free from the surging, and other, troubles which were then being encountered by several axial programmes both in this country and abroad.

Nevertheless, there were difficulties to be surmounted, and these were chiefly related to the compressor blading. As noted previously the Sa.3 introduced blading through-riveted to the compressor discs, and a certain amount of trouble was experienced as a result of fatigue across the rivet holes. A change was



A longitudinal section of the original Metrovick F.9 Sapphire as it was when Armstrong Siddeley first assumed responsibility in 1947.

THIRTEEN-STAGE COMPRESSOR



1 Cartridge-starter breeches.
2 Rotax cartridge starter.
3 Starter reduction gearbox.
4 Starter engagement clutch.
5 Internal wheel case.
6 Accessory-drive coupling.
7 Drive to h-p pump and tachometer.
8 Intake casting.
9 Strut leading edge.
10 Inlet extension piece.
11 Integral front mounting.
12 Tank breather pipe.
13 Overboard breather pipe.
14 Forward lifting eye.
15 Oil scavenge line.
16 Main oil pump.
17 Micropump (centre bearing).
18 Overspeed governor head.
19 Fuel by-pass valve.
20 Dowty fuel pump.
21 Installation trunnion.
22 "Banana" wheel case.
23 Tachometer.
24 Fuel to l-p inlet.
25 L-p filter and flow-control.
26 Distributor (one of six).
27 Fuel and air drain and oil breather.
28 Outlet for bearing-cooling air.
29 Fuel feed (one of thirty-six).
30 Primer jet (one of six).
31 High-energy igniter (one of a pair).
32 Combustion chamber drain.
33 Front main shaft.
34 Oil pump drive.
35 Fixed guide vanes.
36 Locating shoulders on rotor.
37 Holes for eighth-stage air.
38 Tapping for fifth-stage air (one of six)
39 Seventh-stage air for gun heating or cooling.
40 Fuel manifold.
41 Straightener vanes.
42 Centre-section.
43 Slinging unit.
44 Bearing oil down fifth-stage air pipes.
45 Outer flame tube.
46 Primary air tube.
47 Feed-pipe built up to fill hole.
48 Secondary air tube.
49 Primary air tube held by dogged-periphery nut with crimping washer.
50 Primer ring.
51 Spherical bearing.
52 Stator conical support unit.
53 Drillings to admit turbine cooling air.
54 Rear (fixed) cone.
55 Front (split) cone.
56 Front cone retaining nut.
57 Turbine lock nut.
58 Sprung plunger.
59 Sliding gas seal.
60 Torque-transmitting dogs.
61 Cooling air passage around first stators.
62 p_4 governor line.
63 Turbine locking dowel.
64 Metering plug.
65 Exhaust cone shroud.
66 Alfol lagging.
67 Disc with pressure-balance holes.
68 Welded internal stiffeners.
69 Spring latches.
70 Pipe attachment access door.

made to steel blading, also riveted and of identical profile, although further failures across the rivet holes persisted.

Different types of root were investigated in conjunction with blades of increased thickness/chord ratio. The final choice fell upon a type of blade with a serrated (fir tree) root held in a relatively thick, steel disc, and this was the arrangement adopted for the first three rotor stages. Further running resulted in fatigue failures through the serrations but this was completely cured by increasing the root cross-section.

In common with several other axial engines of low hub/tip ratio the first few stages of the Sapphire compressor operate in a semi-stalled condition at low r.p.m. and this resulted in the fatigue failures mentioned above. One of the attempted solutions was the lacing together of the rotor blades in the first stage by a pre-formed wire threaded through small holes at approximately mid-chord near the tips. The presence of this lacing wire sufficed to damp out any resonance. Later development, however, made such measures unnecessary.

In October 1950, a licence agreement was concluded between the Wright Aeronautical Division of the Curtiss-Wright Corporation and Armstrong Siddeley, under the terms of which the American company were enabled to produce the Sapphire in an "Americanized" form. At this time the principal British engine was the Sa.3, and several examples were sent to the New Jersey firm during 1950 and 1951. The history of the Sapphire in the U.S.A. is fully covered later in the course of this narrative.

The only other difficulties experienced with the Sa.3 were relatively trivial failures of the type met in all engine development programmes. For example, the cooling effect of eighth-stage bleed air between the two turbine discs was insufficient, and failures of the locking band occurred. A change to 13th-stage air provided a completely adequate cooling flow. Another source of trouble was the inlet guide vane assembly, in which the blades were brazed at their inner ends to 16 shroud segments, each segment holding three blades. Fatigue failures of this section were stopped by making the shrouds in complete 180-deg segments. Similar experience caused a change in design of the brass compressor stator-blade shrouds; originally in eight segments per stage, they were redesigned in 90-deg quadrants.

Throughout 1951 detail improvements of this nature continued, and in January, 1952, the Sa.3 passed a second M.o.S. type test at 7,590 lb thrust and with slightly better fuel consumption (0.909).

From the outset one of the chief assets of the Sapphire was its ability to swallow a large airflow in relation to the overall diameter of the engine. Nevertheless, the extended bench testing carried out during 1951 with the Sa.3 showed that an even higher mass flow could be accepted, with slight modification to the gas path—such as a reduction in the swirl angle of the inlet guide vanes—merely by running the engine at higher r.p.m. Development became concentrated upon this up-rated engine, designated ASSa.6, and culminated in a remarkably fine type test in March, 1952, at no less than 8,300 lb thrust and with an s.f.c. of 0.9.

High-altitude testing began in August 1951, when two Sapphires, of the Sa.3/Sa.6 type (the latter rating had not then been achieved) were flown in WD 933, the fifth production English Electric Canberra. This was one of the first of many Canberra engine test beds and it has since carried much of the load of Sapphire testing on its broad wings.

As is now self-evident, the Korean conflict caused a rapid increase in procurement for all types of military equipment in Britain and America, and the Sapphire was ordered in quantity early in 1950. The first production order referred to engines of the Sa.3 rating but the Sa.6 development rapidly overtook the tooling-up process, with the result that the contract was changed

ARMSTRONG SIDDELEY SAPPHIRE . . .

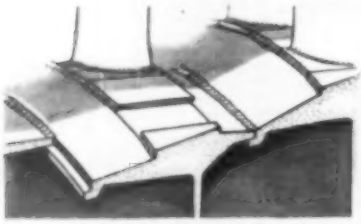
to specify Sa.6-type Sapphires, with no change in delivery date. Large numbers of engines were involved, and the former Hawksley factory at Brockworth, Glos, adjacent to one of the Gloster Aircraft plants, was re-opened specifically for the manufacture of the Sapphire. Tooling continued during 1952 and the first engines were delivered in the summer of 1953.

Since that date the Brockworth factory, operated by a Hawker Siddeley Group company known originally as Brockworth Engineering Co., Ltd., and now as Armstrong Siddeley (Brockworth), Ltd., has been the main source of all British production Sapphires. Research and development has continued at the main Armstrong Siddeley works in Coventry, test-bed running is conducted at Ansty and on the former Avon beds of the Standard Motor Co., at Banner Lane, Coventry, and flight development is based at the Armstrong Siddeley facility at Bitteswell.

At present the ASSa.6 type of Sapphire is the most advanced basic design which can be made public, and a typical engine of this rating is the subject of our large cutaway drawing. This drawing emphasizes the essential simplicity of the engine.

At the right-hand end is the intake body, which is a large sand casting in L.124 light alloy. The basic casting includes four radial struts, the leading edges of which are made separately and bolted on, as is a forwards extension to the central hub portion. Accessory and oil-pump drives can be led down any pair of struts, those chosen depending on the installation. The starter, described later, is attached to the front of the intake hub and a steel housing is bolted on at the rear to carry the Ransome and Marles ball thrust bearing for the front end of the main rotor assembly. The front mounting of the engine (non thrust-carrying) is attached to an integrally cast lug at the top of the intake.

An additional bolted-on extension at the rear of the hub serves to locate the inner ends of the fixed inlet guide vanes, which are cast in S.80 steel. The outer ends of these vanes are located in diagonal slots in carrier half-rings which slide into a recessed groove around the front periphery of the compressor casing. The latter has a constant diameter and is cast in top and bottom halves in L.51 aluminium alloy. The complete casing is held together



A detail of the compressor construction employed in the original form of the engine, showing the location of rotor blades in discs welded together.

by bolts through the integrally cast flanges. External stiffening ribs are incorporated, these being more closely spaced transversely than longitudinally.

After machining to the internal diameter the casing is provided with carrier slots for the 13 stages of stator blading, the eighth to the last stages being similar. The first seven rows of stator blades are close-formed stampings in stainless steel and the high-pressure stages are machined from rough steel stampings. Each half-stage (180 deg) of blades is carried in dove-tail slots in half carrier rings, the first seven stages being cemented in with Marco cold-setting resin. This resin retains the blades rigidly, but from 0.002 to 0.010in of tip-rock is allowed to remain on the h-p stages. The first seven stages are shrouded. Each shroud ring is made in four quadrants from rolled brass strip, holes in the shrouds accommodating small "pips" on the stator blades which are finally induction-brazed with silver solder. The complete half units of stator blades are then slid into grooves in the casing, a locating button on each ring butting against the joint face in each half casing.

The compressor rotor drum is forged in MAT.101 (Armstrong Siddeley specification) aluminium alloy, and is then copy-turned to seven stepped diameters, retaining a constant wall thickness. The large drawing shows the form of the longitudinal dogs which are milled into the outer circumference at each step in order to provide a positive drive to the rotor discs. It can be seen that the first three stages (1-p) comprise relatively thick discs forged in Cr-Mo steel. These are a clearance fit on the drum and their drive is transmitted by Hirth couplings on each stage engaging with coupling rings dogged to the drum, the first stage also being driven by the Hirthed rear face of the front main shaft. The latter is a steel extension from the front of the drum, attached to it by fitted D-head bolts and carried by the front bearing.

All the remaining rotor stages (4th to 13th) employ two discs of S.96 steel for each stage. Each disc is turned, on both sides simultaneously, until the finished diameter on the outer part of the radius is no more than 0.062in.

Blading in the first three rows is close-forged in S.62 stainless steel. The finished blades are slid into fir-tree slots broached in the discs and are then locked by "dumb-bell" clips punched from steel strip. From the fourth to the seventh stage the blades are close-forged in aluminium alloy, machined only at the root and tip, the remaining six stages of blades (8th to 13th) being of stainless steel. Each stage of high-pressure (4th to 13th) blades is carried between the two discs of that stage, to which they are through-riveted with two steel, pan-head rivets to each blade.

Each completed stage, comprising a pair of discs and sandwiched blading, is then induction heated to about 200 deg C, fitted on to the rotor drum and pushed hard up against the appropriate drive dogs. When cold the discs have an interference fit of approximately 0.008in, this being sufficient to keep the assembly rigid even in the face of centrifugal growth or gyroscopic loads. By packing the drum with dry ice the rotor can be dismantled, should this be necessary.

In the assembly of the rotor, rotating shrouds (or spacer rings), are fitted between each adjacent pair of blade stages. Rolled rings of E.N.24V h-t steel are each cut to form two or three final shrouds which are machined to engage with the edges of the blade platforms. When running these shrouds are in very close proximity to the brass stator shroud lips.

At the rear end of the rotor drum is attached the steel rear main drive shaft, secured by fitted D-head bolts, and to this is dogged a steel thrust-equalizing disc carrying stainless-steel labyrinth strips held in place by caulking wire. When the rear end of the rotor is tightened up the six rear rows of blading are pinched by some 0.005in against the rear of a row of flange projections at the seventh stage on the drum. The front of the same flange reacts an axial load imparted by the final assembly of the front shaft, the latter creating an axial "nip" of about 0.020in in the cold, static condition. Thus the entire rotor is maintained in proper axial engagement at all times. Final balancing is achieved with the aid of mild-steel plates bolted to the front main shaft flange and steel blocks located by grub screws in dovetail slots in the rear main shaft.

At the outlet from the compressor is placed a row of stainless-steel straightener vanes. Originally there were two rows, but a single row of wide-chord vanes has proved preferable, and these are retained in helical dovetail slots in a carrier ring bolted to the front face of the engine centre section. These vanes ensure that the air delivery to the combustion chamber is as truly axial as possible.

The centre section itself virtually forms the backbone to the whole engine. To it is attached the compressor casing at the front and the combustion chamber at the rear, and all thrust loads and most of the weight of the engine are borne by the main mounting trunnions, one on each side of this unit. Consisting of inner and outer walls (forming a diffusing passage) joined by 10 radial struts, the original form of centre section was completely profiled from a one-piece forging in MAT.102 aluminium alloy, with a forged diameter of 38in and thickness of 11in. Originally in America (as discussed later) but now also in Britain, this design has given way to a fabricated assembly, although many Sa.6s were turned out with the former pattern.

As now employed in production engines the centre section is formed from simple sections of mild-steel sheet, precision welded together in a jig. The finished weight of the fabricated centre-section differs little from that of the "hogged" light-alloy unit.

At the front end of the centre section is bolted a strong diaphragm carrying the centre bearing; this diaphragm is either an aluminium-alloy forging or a steel fabrication according to the pattern of centre section concerned. The front face of the diaphragm also carries the labyrinth sleeve mating with the labyrinth on the thrust-equalizing disc. At the hub of the diaphragm is shrunk in the ferritic-steel centre-bearing housing.

The rear main shaft is machined from S.96 steel, driving *via* a coupling incorporating fitting bolts, the nut lengths being precisely cut to balance out the front unbalanced couple of the turbine unit. Involute gear teeth on the driven coupling take the drive to splines on the compressor rear main shaft, the rear end of the latter having a moly-lubricated, HTS-steel spherical bearing (51) seating the front end of the main shaft and transmitting the pull of the turbine while permitting slight axial misalignment. The driven coupling also supports the sleeve containing air passages carrying the inner track of the centre bearing.

In a similar manner the rear extension to the turbine main shaft carries the sleeve for the turbine bearing, but this assembly also contains the turbine-locking mechanism. Mounted in the extension is a split cone (55) and locking nut with a spring-loaded plunger (58) which locks against internal teeth in the turbine shaft. When tightened up the whole turbine assembly is locked rigidly against the front (split) and rear cones, dismantling requiring removal of the metering plug (64) and the use of a long-handled spanner pushed hard against the sprung plunger.

Support for the rear roller bearing is provided by a formed,

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"The Armstrong Siddeley Sapphire SA.6 engine has precision cast nozzle guide vanes in Jessop G.39 and Turbine Discs in Jessop H.46."
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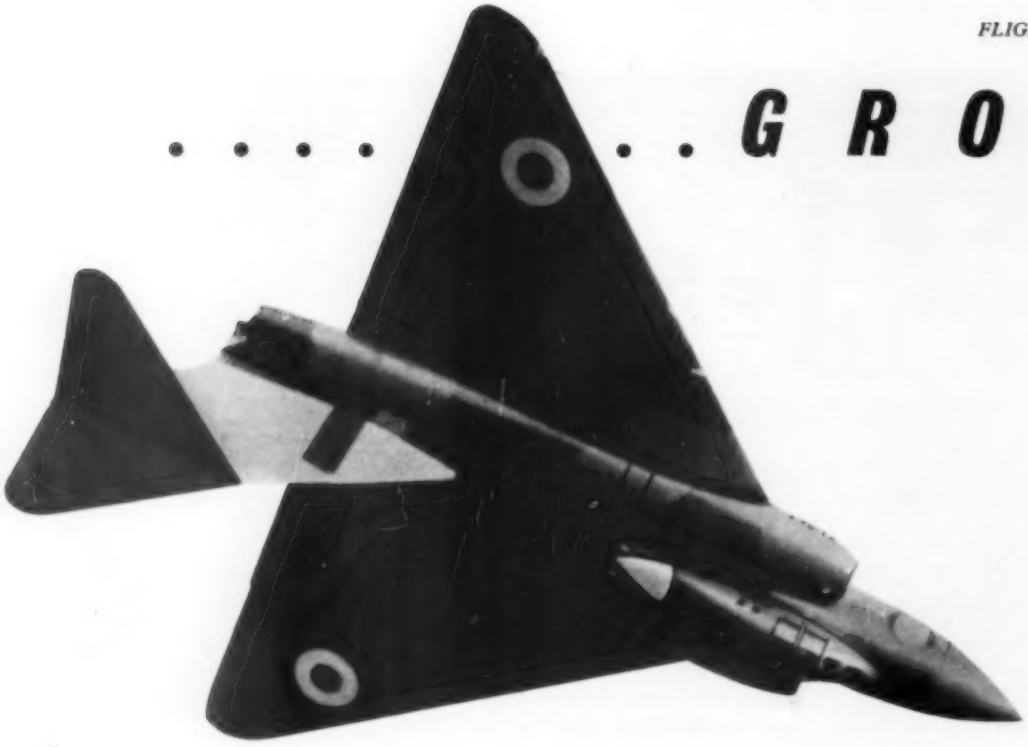

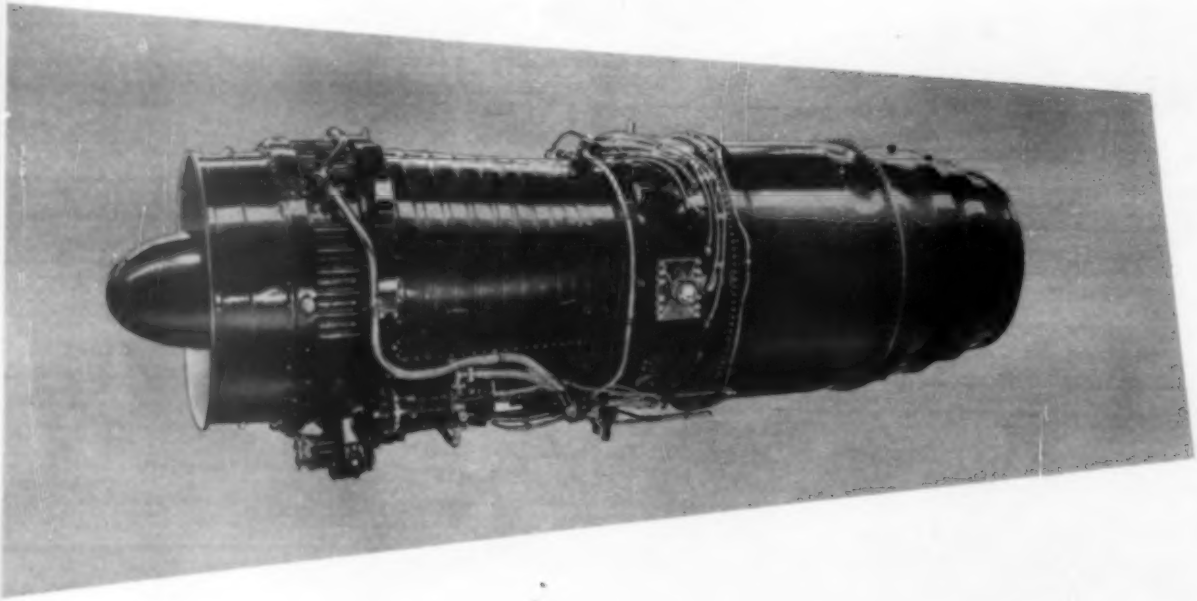

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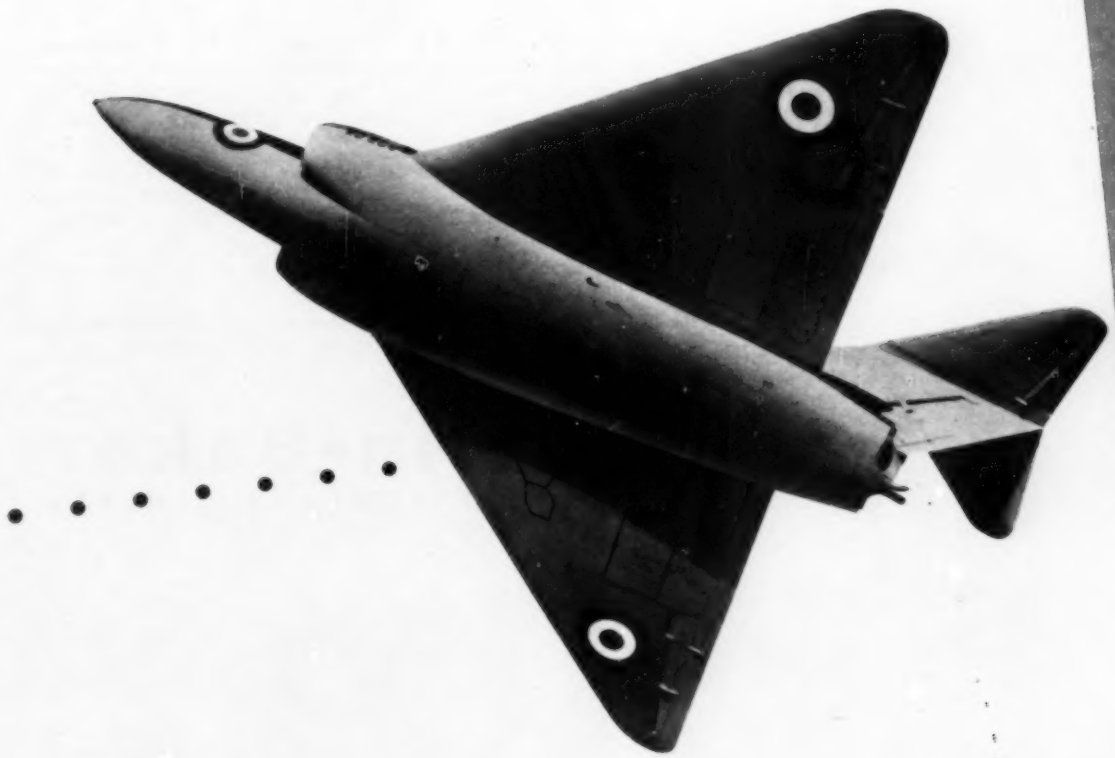
Production Sapphires already make the Javelin one of the most powerful fighters in the world, and at Coventry, Armstrong Siddeley are concentrating on the development of this proven engine to even higher thrust ratings



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Squadron Leader J. S. Fifield, D.F.C., A.F.C., by a recent successful ejection at ground level, demonstrated the capability of the latest Martin-Baker fully automatic ejection seat to bring about safe escapes near the ground at low forward ejection speeds. A further important requirement of an ejection seat lies in its high altitude performance. Martin-Baker fully automatic ejection seats are designed to bring the seat occupant safely down from the ejected altitude, stabilised and under control, to a selected altitude at which parachute deployment and separation of the occupant from the seat is automatically performed.

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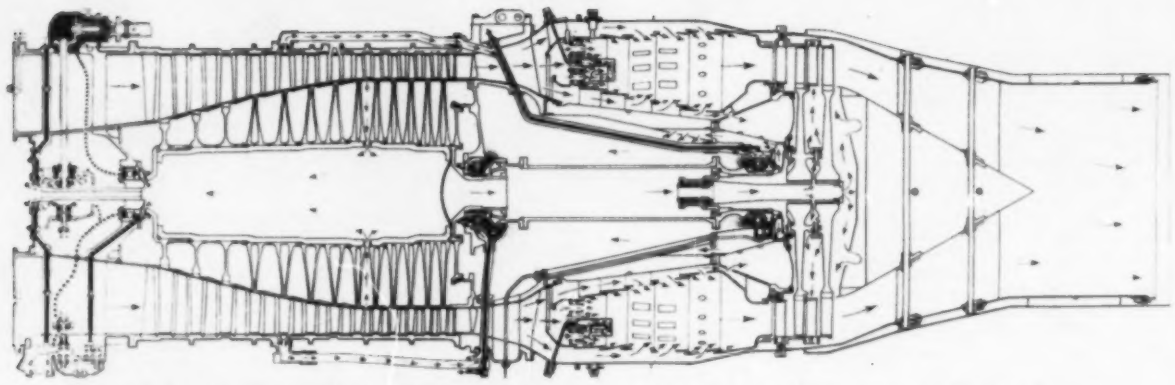


Oil and air flows are indicated in this diagram of an engine of Sa.6 rating. Both systems are described in the text.

ARMSTRONG SIDDELEY SAPPHIRE . . .

mild-steel extension from the rear of the centre section. At the rear end of this truncated-cone assembly is bolted a strong diaphragm which carries both the rear-bearing housing and the stator conical support unit which is referred to later.

Around the portions just described is arranged the combustion chamber. As shown in the drawing on p. 18 the original Metrovick Sapphire also had a truly annular combustion chamber employing atomizers injecting upstream but otherwise of fairly conventional pattern. Armstrong Siddeley, however, had obtained gratifying results from a vaporizing system, which was wholly novel when it first appeared in 1943.

A detail sketch clarifies the manner in which fuel is fed, at relatively low pressure, to 36 feed pipes arranged evenly around the upstream end of the chamber. This fuel is allowed to flow, without any attempt at atomization, into the primary air tube (of Nimonic D or Immaculate 5) immediately downstream from each feed pipe. A very rich mixture of fuel and primary air then passes along the primary air tube, the wall temperature of which is high enough to cause rapid vaporization of the fuel without carbon formation, this process being further assisted by a turbulence pin welded across the gas path. From the upstream-facing outlet there issues a jet of true vapour of whatever fuel is being used, combustion starting in the rich mixture at the end of the tube and continuing in the more-nearly stoichiometric region outside.

Around the front of the chamber is a ring of D.T.D.493 stainless plate, drilled to receive the 36 primary and secondary air tubes, each of which is flanged and welded on, and carrying nine bayonet brackets around its outer periphery which engage with a similar number of pins welded to stainless-steel sheet aerofoil struts. This secures the forward end of the flame-tube assembly to the annular rings which form the aerofoil-section combustion chamber nose piece.

This nose piece divides the flow into primary air (which enters the primary mixing tubes), secondary air (which enters through the back plate and the *ad hoc* secondary tubes) and cooling or dilution air, which passes along the inner or outer walls of the chamber and enters the combustion space at various points along its length. The flame tubes are built up from rings of D.T.D.493 sheet, spot-welded together *via* corrugated spacer rings through which a considerable amount of film-cooling air enters. The bulk of dilution air passes through the flame-tube perforations.

Loads on the complete assembly are taken out through the nine bayonet attachments at the forward end, the chamber being turned slightly to lock in position until a bracket on the inner flame tube locates between matching lugs on the stator conical support unit. At the rear end is an expansion joint which locates on an extension of the turbine nozzle assembly to provide a gas seal.

The outer casing is fabricated from two pressings in stainless-steel sheet, flanged front and rear. This casing carries the main loads from the turbine stator assembly and exhaust cone.

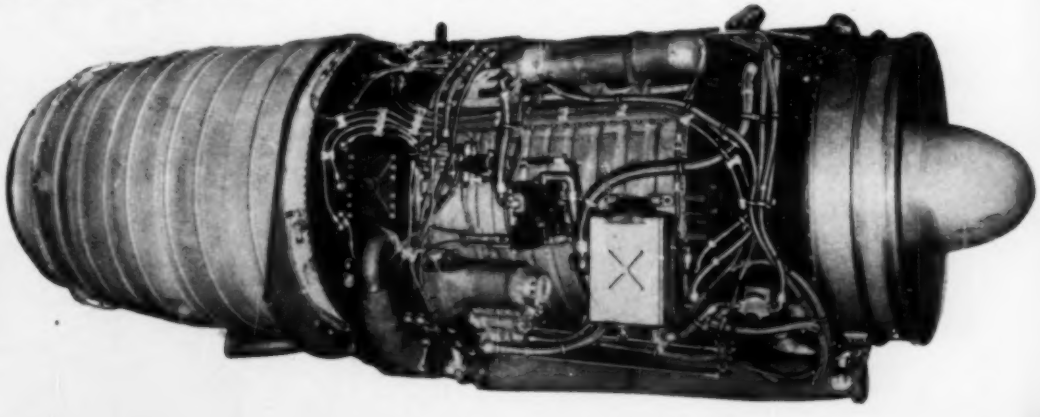
There are two stages in the turbine, each disc being forged in ferritic steel (Rex 448 or Jessops H.46). The discs are dowelled together, and the front disc is, in turn, dowelled to the turbine stub shaft. Taper dowels are used, inserted radially into flanges and retained by grub screws in a peripheral locking ring. First-stage blading is in Nimonic 90 and second-stage in N.80A, all blades being held by fir-tree roots and locked by special split pins.

Surrounding the turbine assembly is a series of ring assemblies, bolted together, which carry the outer ends of the stator blades, all of which are cast in N.80. The first row of stators are supported at their inner ends by a blade support ring which is dogged to a machined ring at the end of the stator conical support unit to take the torque reaction. Part of the first-row torque is also taken out through the outer periphery and combustion-chamber casing. The blade support ring is axially free, and carries a large sealing ring at its forward end locating in the rear of the combustion chamber. The blades themselves are radially free to permit them to expand. To the rear extend the stator rings, the second stage of stator blades being cantilevered from this assembly. The inner end of each second-stage stator blade carries an individual shroud section with a knife-edge running close to the extended platform of the first-stage disc. Cool air passes around the outside of the turbine assembly, through holes between the torque-reacting dogs of the first stator stage. In the outer casing a packing ring, of selected thickness, is inserted immediately ahead of the dog ring in order to meet the correct axial tolerances. Thus the whole section is free to expand radially, although axially clamped.

The exhaust cone is a conventional assembly, with four struts, each containing two tubular cross members, through-bolted to the exhaust unit, the central bullet being fully floating. Light-alloy outer shrouds are fitted, separated by a layer of Alfol lagging. The large cutaway drawing shows the manner in which "curtain wire" springs are used to hold the shrouds together. The access door immediately downstream of this point is used in securing clamps at the jet-pipe attachment, which has a sliding seal.

A separate drawing clarifies the flows of cooling air. Eighth-stage air is extracted through slots in the corners of the rotor blades and led to the interior of the compressor drum. This pressurizes the piston-ring oil-seal on the front bearing and then escapes through a labyrinth back into the compressor entry. Fifth-stage air is tapped off from the compressor casing at six points, and led through Tungum pipes (externally) and steel tubing inside the engine. Four of these pipes lead to the rear bearing and two to the centre; the latter flow passes through the bearing and escapes through a labyrinth into the inner annulus, and the rear flow has to circumnavigate two labyrinths in series. Final escape is through the hollow struts in the centre section.

Full 13th-stage pressure is passed down between the thrust equalizer and the 13th-stage disc to the rear main shaft. This flow is separated from the eighth-stage pressurizing air by a steel blanking disc at the rear end of the compressor drum. From the rear main shaft the 13th-stage air flows aft to pass between the first and second-stage turbine discs (there being suitable ports in the inter-stage coupling flanges) and a proportion is also



Latest and most powerful Sapphire which can be illustrated is the Sa.7; this is the first photograph to be published showing a production engine at this rating.

ARMSTRONG SIDDELEY SAPPHIRE . . .

metered up the rear face of the second disc. Dilution air from the combustion chamber can escape through holes in the stator conical support unit to the front face of the first disc. Further dilution air can also assist in cooling the turbine stator assembly.

Oil pressure is provided by a gear pump driven off the internal gearbox at the front of the engine. Full flood is supplied to the front bearing, to the accessory gearbox and to the starter gearbox. A sump is incorporated in both the internal and the starter gearboxes. The centre and rear bearings are supplied with metered oil from Tecalemit Micropumps, one of which feeds each bearing with roughly one-half pint per hour, this being a "total loss" flow.

As commented upon in the combustion-chamber description, no very high fuel pressures are required. About 400 lb/sq in is the maximum at the burners, and this is supplied by a Dowty ENG.129 fuel pump (fully described in *Flight* of February 20th, 1953). From the tank fuel is passed through a large, low-pressure-drop filter, and thence through the pump to an air/fuel ratio control (Lucas) employed in acceleration, to a barometric flow control (Armstrong Siddeley development and Hobson manufacture), and, *via* a pressure-increasing valve (this maintains pressure in the system during the starting cycle to ensure operation of the servo units), to the six flow distributors each of which feeds six primary feed pipes.

So much for the Sa.6 Sapphire, which has now been delivered in quantity—mainly, one might assume, for Javelins and Hunters. In the former aircraft a Rotax CT.0201-L two-shot cartridge starter is bolted directly to the front of the intake-hub and is faired by a bullet. Gas for operation of the starter is fed through streamline struts from remote cartridge breeches, the latter exhausting under the fuselage. In other aircraft—presumably the Hunter—the breeches are mounted on the starter itself, but well enough forward to lie between the twin intake ducts.

Almost identical with the Sa.6 is the Sa.12, which is now probably succeeding it in production. From the 8,000 lb service rating of the Sa.6 the Sa.12 has jumped to a service type-tested thrust of 8,500 lb, and this would seem to have been achieved largely by increasing the turbine entry temperature by a significant amount. In this engine the first-stage turbine stator blades are fabricated from G.39 alloy, and G.42 is used in the first-stage rotor blading (one of the first recent instances of a British aircraft turbine not using a Nimonic alloy). The second-stage rotor blades remain Nimonic 80A.

For the second generation of Sapphires the story must begin again in 1951. In that year it was considered that, good as the Sapphire was from the viewpoint of air-swallowing, a greater mass flow could obviously be accepted if the intake end of the compressor were opened out to the same diameter as that across the combustion chamber (then the widest portion of the engine). This was accordingly done in the Sa.4, which, as far as can be judged, was otherwise generally similar to the Sa.3/Sa.6. Although it is probable that the Sa.4 ran at the same r.p.m. as did the contemporary Sa.3, it delivered no less than 9,700 lb thrust on its first acceptance test in July, 1952. Such is the potency of increasing the mass flow.

At this time the Sa.3 was being turned into the Sa.6 largely by increasing the governed speed, and it was appreciated that the same sort of thing could be done to the Sa.4. As a result a fairly extensive redesign was undertaken and the resulting engine, designated Sa.7, was first run, in prototype form, in August, 1952. As the photograph on p. 21 shows, this engine differs considerably from the Sa.6, particular points of note being the tapered compressor casing, the Delaney Gallay or Serck fuel-cooled oil cooler, the provision of hot-air de-icing and a reduction in the number of burners to 24. In the summer of 1954 this type of Sapphire was flown in the company's Canberra, and a type-test was passed in October of that year, at 10,200 lb thrust, with the remarkable s.f.c. of 0.885. Finally, in the spring of 1955, a type test with the Sa.7 was run at 10,500 lb thrust, and possibly higher ratings are in prospect. The Sa.5, Sa.8 and 9 also exist.

Armstrong Siddeley's great work on the Sapphire can be concluded by briefly referring to their work on afterburning—or, as it is usually termed in this country, on reheat. In the early part of 1954 the flight development section at Bitteswell started flying a second Canberra B.2 which had been converted to take two Sapphires with reheat. Fixed-area nozzles have been fitted for development flying, and the area would in this case be that appropriate to the reheat case, so that considerable thrust loss must inevitably result in the unaugmented condition.

Although precise details may not yet be published it can be said that Dowty Fuel Systems, Ltd., have co-operated with Armstrong Siddeley in this development, and an ENG.181 pump is employed in conjunction with an ENG.224 throttle control, giving rise to the supposition that the boost is infinitely variable. It is instructive to speculate upon whether or not it has been found possible to employ a vaporizing type of injection system in the Sapphire afterburner; obviously vaporization would be much easier in so hot an airflow, but actual control of combustion would seem to pose several problems.

In conclusion, something should be said of the work of Curtiss Wright in turning this sound British design to good purpose for both the U.S.A.F. and U.S. Navy.

By March, 1951, the first American version, designated J65-W-1, was running at Wood-Ridge, although in January the prototype Republic XF-84F had flown at Farmingdale with a Sapphire that was largely British. During 1952 the J65-W-1 passed into full production at Wood-Ridge, and the Buick motor division of General Motors were brought in as a second source. During 1952 the latter company's large plant in Flint, Mich., was fully tooled for production of the J65-B-3.

Armstrong Siddeley agreed with Wright in rejecting the original design of centre section, and each company evolved a new design. Wright chose a fabricated assembly welded from Ni-resist (International Nickel) nodular iron (spheroidal-graphite cast iron). Not only was this considered a more practicable production job but the cost was estimated at one-fifth of that of the "hogged" piece, assuming American labour rates. Flexible braided pipe replaced the rigid tubing on the outside of the engine and the starter motor adopted was either an electric motor contained under a long fairing or—in fighters—a 340 h.p. Bendix (Eclipse Pioneer) fuel/air turbine unit. Martin B-57s, however, retain a cartridge starter, with very smoky filling.

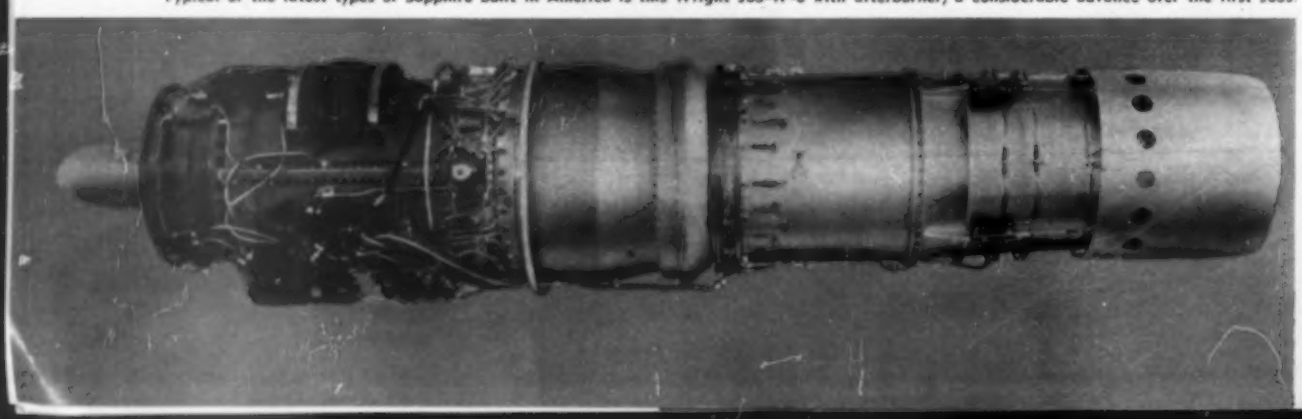
One of Wright's devices for improving compressor behaviour was a flow modulator, or annular ramp around the inner radius at the entry to the compressor. The effect of this was to increase flow velocity by reducing annulus area and so smooth out the flow and reduce effective blade angles. All J65s for the U.S. Navy incorporate this feature and it is also thought to have been fully examined at Coventry, although not fitted to British engines.

Mention should also be made of a shaft-driving development of the Sapphire which is the result of Wright and Armstrong Siddeley co-operation. The basic gas-producing section of this engine remains essentially unchanged, but a third turbine stage has been added to provide surplus power which is taken out through a large reduction gear added at the front. Rated at present at around 10,380 e.h.p., this engine is the most powerful turboprop to have flown.

In 1952 a considerable amount of work was started upon afterburning, and a full-reheat unit, with clamshell nozzle, has now been cleared for operation. One of the most recent J65s, complete with afterburner, is illustrated here. This engine also typifies the new design of J65 compressor casing, in which increased stiffness and thickness—made mandatory owing to bursting loads at high Mach numbers and deflection caused by the plurality of devices hung on the casing—have permitted deletion of the exterior stiffening ribs. Nevertheless, all J65 casings are light alloy in marked contrast to the latest Armstrong Siddeley practice.

The basic engines of this series are rated at about 8,000 lb thrust and must give over 11,000 lb with reheat. Both the Grumman F11F Tiger and the (Mach 1.6) Lockheed F-104 are at present equipped with engines similar to that illustrated. Wright and Buick production has now topped the 7,000 mark and will continue at least through 1957.

Typical of the latest types of Sapphire built in America is this Wright J65-W-6 with afterburner, a considerable advance over the first J65s.



(5) MERITS OF THE GNAT

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(b) A one-piece wing which, secured to the fuselage at only four main points and carrying no fuel tanks, armament, controls or landing gear, can be fitted and removed with little trouble.

(c) A single inspection panel that gives direct access to all engine accessories.

(d) A quickly-removable rear fuselage and a short cantilevered jet-pipe, which facilitate engine change.

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(2) combines hard-hitting armament with exceptional stability at all speeds.

(3) can be transported more easily, and is less exacting in its airfield requirements.

(4) is easier to produce.

(5) costs far less to buy and operate.

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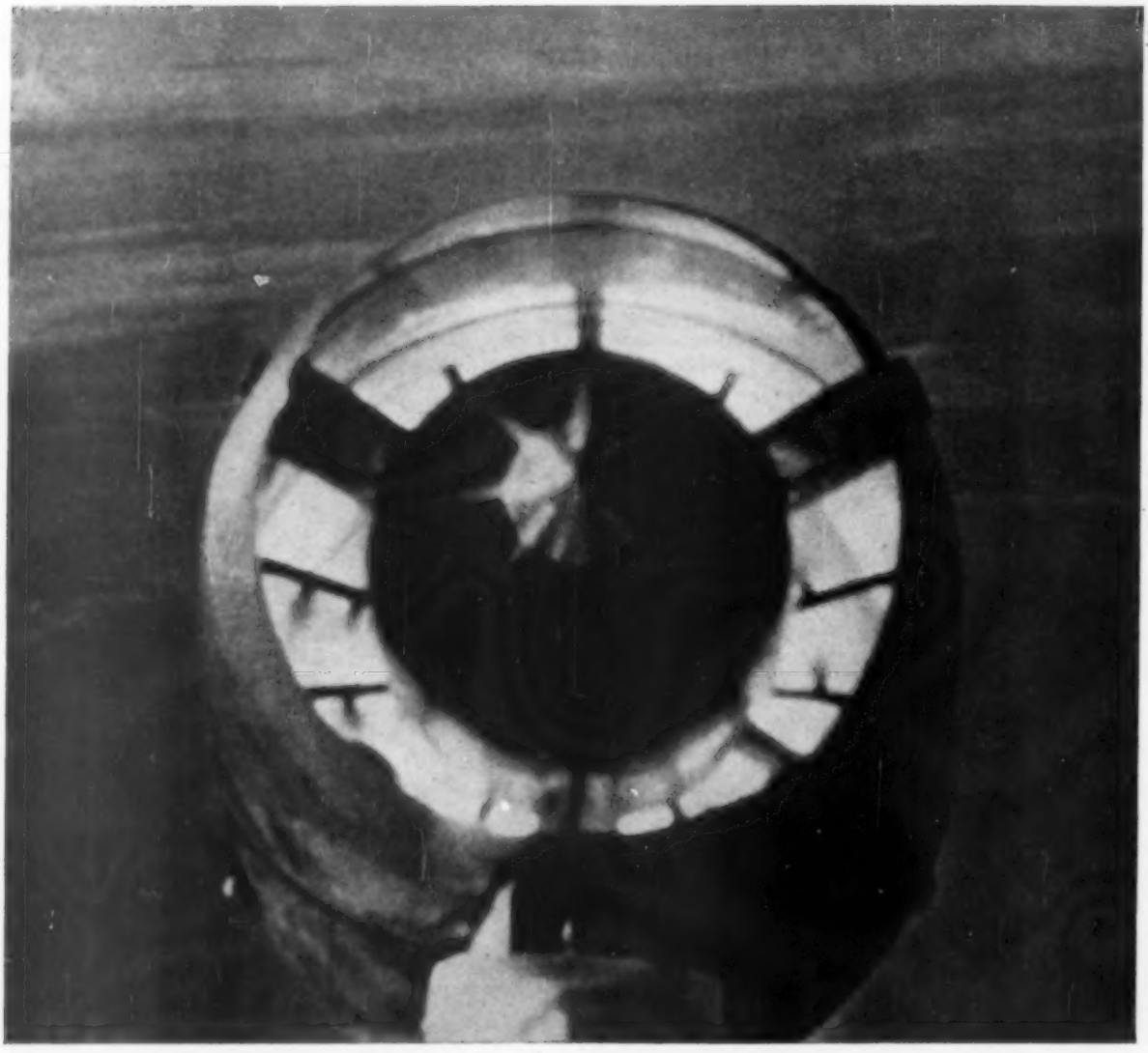

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THE AIRPORT AND THE STATE

An Official Investigation into the Management of British Airports

STRONG dissatisfaction with the policy of the Ministry of Transport and Civil Aviation towards the commercial aspects of airport management is certain to be the reaction of any taxpayer who reads the recently published official report* on British civil aerodromes and ground services. The report, by the Select Committee on Estimates, is a rather forbidding-looking document of nearly 300 closely printed pages, consisting largely of lengthy transcripts of verbal evidence. For this reason, perhaps, its findings have not been widely publicized in the national Press, though "revelation" would not be too strong a word to apply to some of the facts disclosed in the report.

As observed in *Flight* recently, the majority of the world's airports are run at a loss. It is very doubtful, however, if the M.T.C.A. are doing everything possible to reduce airport losses, or if they have any plan for reaching the break-even stage.

One reason for the Ministry's passive, unenterprising approach to financial matters is the lack of a costing system resembling even remotely the balance-sheet of a normal trading concern. The report notes that when a Government Department (such as the Mint or the Stationery Office) operates a commercial undertaking it is required to present annual trading accounts to Parliament. So far as airport operations is concerned, this practice was suspended in 1950, because it was not possible to devise a realistic system of accounting. No attempt to do so had been made since that time.

According to the Ministry, the net operating cost to the Exchequer of M.T.C.A. airports for each of the past two financial years was in the region of £1.66m. This figure did not take into account interest on capital, depreciation on runways and buildings, or cost of administration away from the airports. On a true commercial basis, the cost of operating U.K. airports and ground services in 1954-55 was about £6m. "This information," the report observes, "is not available to Parliament or the public."

In 1945, the report recalls, the Government decided that all airports from which scheduled services were operated should be State-owned. This policy had subsequently been modified, the first departure from it being the agreement that Manchester Corporation should retain ownership of Ringway (which had not been requisitioned). The agreement, reached in 1950 but not signed until five years later, was apparently advantageous both to the Corporation and to the Exchequer, who would save about £650,000 over the next few years. The report recommended that other municipalities should be encouraged to own and operate their own airports, and that the M.T.C.A. should accordingly restate their policy on municipal ownership of aerodromes and the conditions on which agreements should be based.

Discussing the question of capital expenditure on airports, the report reasons that a more rapid expenditure on capital works would reduce the loss incurred in the day-to-day operation of airports. It seemed important that the expenditure necessary at Gatwick should be hastened as quickly as possible; the combined operating loss at Bovingdon, Croydon and Stansted over the past two years—£158,000—was equal to interest at 4 per cent on £4m, two-thirds of the cost of the first stage of developing Gatwick.

The committee found it impossible to judge whether financial limitations imposed by the Treasury had in fact delayed development, or whether the slow progress was caused by policy changes or shortage of labour and materials. It was not their duty to recommend more expenditure of public money, but they felt that at least part of the difficulty arose from the fact that capital expenditure was found by the Treasury out of current taxation, involving the rigid Parliamentary system of Estimate, Vote and Appropriation. The report urged reconsideration of the possibility of grants-in-aid or quinquennial grants.

The report observes that, when questioned as to M.T.C.A. policy towards creating and increasing traffic at their airports in order to decrease the charge to the taxpayer, the Northern Divisional Controller stated that it was no part of his duty to seek new business or traffic for the aerodromes within his responsibility. At the same time, he had many suggestions to offer on how the traffic could be increased—particularly at Liverpool, where an unexplored traffic potential was the justification for keeping the airport open despite a loss of £11,000 in the last financial year. This official considered that it was the Liverpool Corporation's duty to press their demands on operators for increased traffic at Speke Airport, Liverpool, though, as the report drily observes, "this solution would appear to be abdicating the Ministry's financial responsibility to a body with no immediate interest in the aerodrome's profitability."

The Permanent Secretary of the M.T.C.A. confirmed his Northern Divisional Controller's statement by saying: "We do not try to attract traffic . . . the object is not to make as much money as we can on the aerodromes or even to make them pay." The report concludes that not only were the M.T.C.A. making no effort to reduce the cost to the taxpayer by increasing traffic but that, by implication, they were "contentedly acquiescing in subsidizing all travellers by air whether British or foreign."

The report devotes considerable space to the possibilities of raising landing fees and passenger service charges in order to reduce running cost of the British airports. Five reasons had been given by the Ministry for not raising landing fees at present:—

(1) Charges are already higher than in other European countries;
(2) Inter-continental traffic might be diverted to foreign airports;
(3) There might be a general raising of fees in other countries;
(4) The air transport industry is still faced with rising costs in numerous directions and it is therefore premature to increase charges;
(5) The expansion in traffic has led to an average increase in revenue of 10 per cent yearly since 1950 and will continue to do so for some years to come.

On balance, the Committee did not believe that some increase in fees would in fact put British charges seriously out of line with those of other European countries, and they also felt that the fear of diversion of traffic to foreign airports was much over-rated. The Committee felt that people who enjoyed the attraction of flying should not be indefinitely subsidized at the expense of public funds. Having weighed the various arguments, the Committee recommended that landing fees should not be increased.

Despite the objections of airline operators to the passenger service charge, the report agreed with the opinion of the M.T.C.A. that it was "a very good and a very fair charge." The Committee felt that the charge could be included in the fare paid by the passenger, and had not heard any good reason why this had not been done. The report went on to recommend that the charge should be reviewed with the object of "(1) Setting the basic rate higher and allowing the same rebates and surcharges as apply to landing fees; and (2) considering whether the charge should be levied on the operating companies in respect of passengers landing rather than departing."

Airport concessions let by the M.T.C.A. had produced £160,000 of revenue in the past financial year. This represented only six per cent of all revenue at airports from fees, rents, charges and concessions. Manchester Corporation had stated that it was their aim to raise no less than 60 per cent of their revenue from concessions and from the non-travelling public. At many U.S. airports, income derived from sources other than those actually connected with the operation of aircraft and the movement of passengers amounted to 40 per cent—and in some cases to as much as 85 per cent—of the total revenue. The Ministry figures seemed so out of line with practice elsewhere that the Committee had asked for opinions of B.O.A.C. and B.E.A., with their world-wide experience, on the subject of amenities and concessions. Their joint conclusions are summarized as follows:—

"(1) There should be a more aggressive commercial approach in developing amenities and the matter should be treated as one of some urgency so that the revenue-earning aspects of airports may be made fully productive as early as possible;

"(2) Airport managements should be given greater autonomy in financial affairs, with the object of achieving the financial solvency of individual airports and aerodromes."

These suggestions were endorsed by the report, which concluded that more urgent measures should be taken by the Ministry to develop amenities and concessions.

Finally, the report reviews the arrangement whereby constructional and maintenance work on M.T.C.A. airports is carried out on an agency basis by the Air Ministry Directorate-General of Works. The Treasury would allow the Ministry to use outside consultants and architects as long as the Air Ministry staff provided for the purpose were not under-employed; the Ministry had, however, employed private consultants, and had paid them £29,800 for their services, whereas the Air Ministry would have charged £45,400. The clear danger of the Treasury's attitude, the report comments, "is that the Air Ministry's staff may be maintained at an unnecessarily high level." Of the £543,000 paid to the Air Ministry by the M.T.C.A. in the last financial year, £100,000 was paid by the Air Ministry to outside consultants employed by them. It was not clear why the M.T.C.A. should not employ these consultants direct, thereby saving the Air Ministry's departmental expenses.

*"*Civil Aerodromes and Ground Services.*" *Report by the Select Committee on Estimates. H.M. Stationery Office, London. Price 13s 6d.*

EASY-GOING AIRLINE

Amsterdam to Johannesburg in Tropic Airlines' Avro York—with an Ex-Richthofen Pilot

By K. WESTCOTT JONES

A PRIVATELY owned South African airline operating a fortnightly service with a York from Johannesburg to Amsterdam is looking forward to some expansion during the coming year. At the relatively low fare of £198 return (£105 single) the demand for seats in the 53-seater York has been heavy for most flights; but the attraction of the service has been built up largely on the strength of two stops of nearly 24 hours each, with accommodation provided free, during the leisurely four-day journey.

Since early autumn of 1955, the name of Tropic Airways 1955 (Pty.), Ltd., of Johannesburg, has been heard in London, where a new office has been opened. The airline is better known, however, as Creed Air Transport, and the York carries the letters C.A.T. on its fuselage sides, with only small insignia on the nose indicating the new Tropic title.

I recently made a return journey from London to Johannesburg, *via* Amsterdam, with this airline. A number of points of interest emerged from what proved to be a highly satisfactory trip, slightly reminiscent of flying in earlier days.

Tropics York was once the personal aircraft of Field Marshal Jan Smuts. It is still named *Cubaas*, the affectionate title by which the great South African statesman was widely known. It carries the registration letters ZS-DGN, and is a comparatively youthful aircraft as far as flying is concerned, having completed just over 4,000 hours.

Capt. Harry Creed, chairman of Tropic, and his managing director, Mr. Ernest Abbott, have plans for the expansion of the line, plans involving the use of four-engined aircraft; having established a reputation for a four-engined route to Europe, they have no intention of purchasing Vikings already offered to them. When additional equipment becomes available, the York may be relegated to freight working only. Although future schemes for development are still in the embryo stage, I can confirm that excellent relations exist between Tropic's management and the South African Minister of Transport, the Hon. B. J. Schoeman.

At present, Tropic departures from Amsterdam, where the line's affairs are handled by Aero Ground Services, Ltd., take place on the 7th and 22nd of each month; northbound services from Johannesburg are on the 1st and 15th. Schedules appear to be kept with a high degree of punctuality. On my outward journey, the Johannesburg arrival was exactly one minute before time (doors open); returning to Amsterdam, we were two minutes early. Glancing through past records, arrivals appear to be in keeping with this remarkable demonstration, although at times it has been necessary to clip night-stops to attain them.

Chief pilot of Tropic is Capt. Kurt Kaye, a veteran flier with an amazing history. As Capt. Kayzenstein, he flew with the Richthofen Circus during the First World War, incidentally teaching Herman Goering to fly. A vigorous anti-Nazi, he found it necessary to flee Germany in 1934, and emigrated to the Union of South Africa. During World War Two he served in the South African Air Force, and taught thousands of young men from all over the Commonwealth to fly bombers.

Kurt Kaye handles his York with a mixture of skill and affection. He and his crew of six are always together, which means they really know the aircraft, with all its good points—and bad ones. I noted that the crew seemed to have a horror of the "slip" system employed by major airlines, and, even in the event of considerable Tropic expansion, intend to remain with one aircraft throughout a flight.

Leaving Amsterdam at 1100 hr, the York flies to Rome, taking 4½ to 5 hr. Twenty-four hours are spent at a first-class hotel in the city before departure for Wadi Halfa. When I was on board, this second leg of 1,820 miles took 8 hr 22 min. The refuelling stop at Wadi gives an opportunity for a midnight supper, then the third leg (1,625 miles) to Entebbe is flown. Arriving at Entebbe at 1030 hr, the York remains there until 0700 hr next day. Passengers and crew are accommodated at the Lake Victoria Hotel, but facilities are afforded for visits to Kampala, the lake shore, and other places of interest. The last section to Johannesburg is flown on the fourth day out from Amsterdam, and is the longest. Some 1,850 miles of Central and Southern Africa pass beneath the wings, and it is invariably rough, becoming worse after the aircraft crosses the Limpopo River, when the High Veldt rises to 5,000ft above sea level and sufficient altitude cannot be obtained to avoid the bumps from the sun-drenched land.

With the clocks going back one hour, Johannesburg was reached at 1529 hr. Passengers are disembarked at the new Jan Smuts Airport—with its magnificent runways and buildings but complete lack of reasonable facilities for creature comfort—then the York takes off again for Rand Airport, Germiston, where it is serviced during its five days' rest.

My return flight was delayed 24 hours—not by any technical hitch, but by a jewel robbery! The Oppenheimer jewels, worth more than £230,000, had been stolen shortly before I arrived in the Union. Tremendous efforts were being made to recover them, and the evening before our scheduled early morning take-off, they were discovered and arrests made. They were in a cardboard box ready for shipment to Amsterdam—in our York! A suspect was taken off by the police to be charged with complicity in the biggest jewel robbery in history. But two diamonds worth about £15,000 were still missing, and, at the urgent request of Tropic's managing director, the York was searched from stem to stern in case the suspect had "planted" them. They were not found, but the York was delayed 24 hours. As a result, the return flight was shortened, with two night stops—at Juba (Upper Sudan) and Benina (Libya) to give an on-time arrival in Holland.

Informal conditions impart an atmosphere rather resembling that of a good-class guest-house on wings. Food and drink are supplied at frequent intervals by a steward and stewardess, though luxury trimmings are omitted. If some particularly interesting scenery comes up, the captain will circle and come lower for photographic purposes. After leaving Juba, for example, we followed the White Nile at low altitude, watching the massive herds of wild elephants which inhabit that part of the Sudan. When numerous animals were sighted at a water hole, we flew low to take a better look at them, photographing buffalo, rhinos, hippos, and buck. No effort is spared to inform passengers of the whereabout of the aircraft, and to name towns, lakes and rivers being overflown. Before taking off, Capt. Kaye gives a short talk to passengers concerning points of interest about the flight about to be made.

The seats in the York are deeply reclining; made of leather, they are quite comfortable, but they have no centre armrests and the two occupants share a single seat belt. Noise level, as in all Yorks, is rather high, and I noted that every passenger used cotton wool. A few of the luxuries fitted when the aircraft was in Field Marshal Smuts' possession have been retained, such as elaborate panelling, two large observation windows, and two well-appointed toilets. There is no public-address system; messages from the flight deck are passed by shouting, or by writing on small blackboards.

Although I have travelled to South Africa on several previous occasions by sea and air, or a combination of both, I have never seen so much of the "Dark" Continent as on this scenic air cruise with Tropic.

BRAZILIAN SAUCER-MAKER

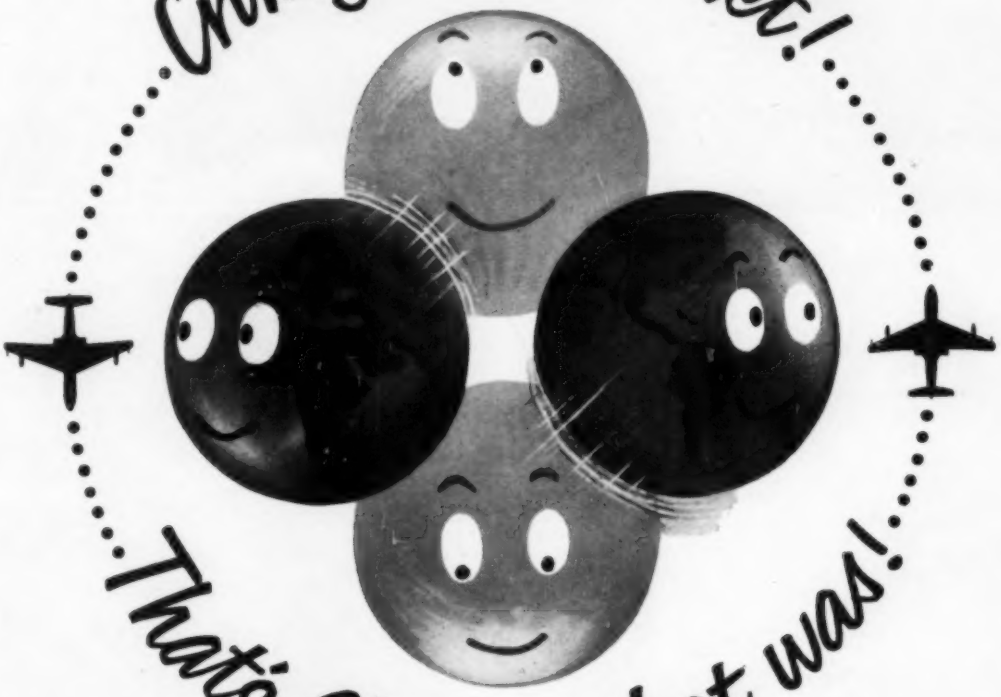
INVENTORS anxious to promote their ideas frequently seek our aid. One such is a Brazilian engineer, Ernest E. Geiger, of Sao Paulo, and his communication has the merit of including actual test results.

He has been expérimenting with an annular wing in the form of a convex disc with a large central orifice in which is placed a centrifugal fan producing a high-speed radial flow. The flow of air outwards over the disc, and its consequent downward deflection by the disc contour produces lift which is symmetrical around the disc and generally independent of translational velocity of the device through the surrounding atmosphere.

Using a disc with 490 sq cm effective area and a flow velocity of 8.7 m/sec at the periphery of the blower, the induced lift was measured to be 110 grammes; this reduces to 0.224 gm/sq cm. Assuming all other things to be equal, and taking lift as being proportional to the square of the airspeed over the wing, this seems to be about the same level of performance as that achieved by fixed-wing light aircraft.

At present Sen. Geiger is trying to establish the optimum geometry for such a layout, with particular emphasis on the correct thickness of radial flow for a given convex surface. His address is Rua Bertioga 261, Vila Mariana, Sao Paulo, Brazil.

Crikey! The Comet!



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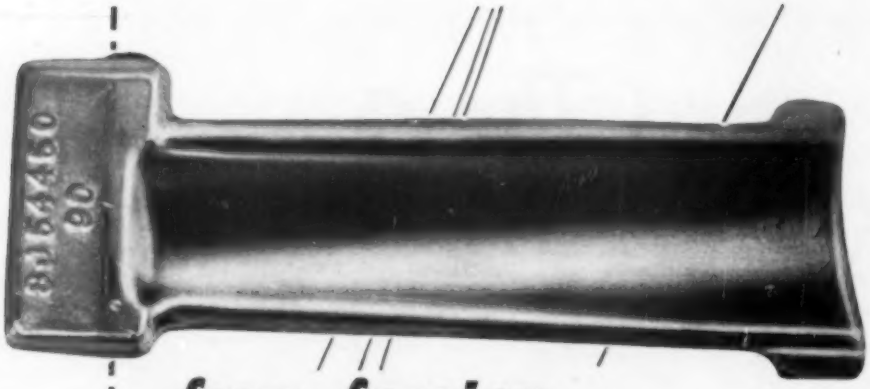

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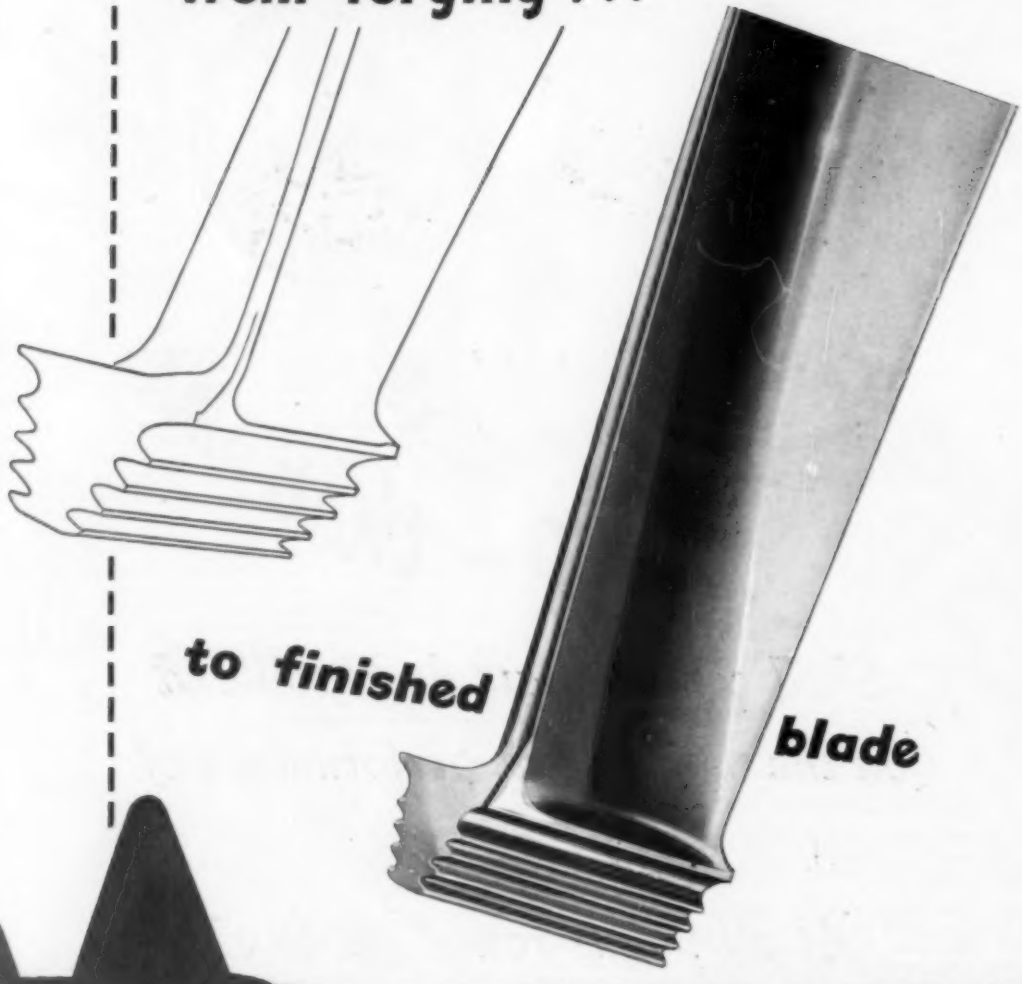

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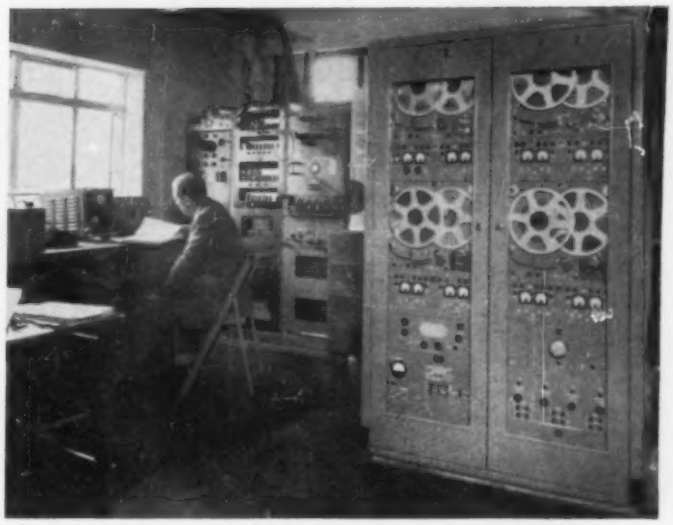


This Simon long-duration tape recorder, Type LTD.14, for monitoring ground/air and other communications, is installed in the control tower at Farnborough. Simon Equipment, Ltd., 46-50 George Street, London, W.1, are the makers.

THE INDUSTRY

Bristol Ramjet Re-organization

TO meet growing activities in the field of ramjets, and important developments foreshadowed in work on guided missiles," Bristol Aero-Engines, Ltd., have re-organized their ramjet department.

Dr. R. R. Jamison has been appointed head of the department and an assistant chief engineer of the company. His former position as engineer-in-charge of ramjet development is taken over by Mr. M. A. Nedham, while Mr. H. M. Gorrell is appointed chief designer (ramjets). Both are directly responsible to Dr. Jamison.

Another change is the appointment of Mr. E. S. Mizen as ramjet test engineer, with direct responsibility to Mr. Nedham, while Mr. R. G. Neal, formerly of the research test engineer's department, has been transferred to the ramjet development department, where he is responsible to Mr. Mizen.

Napier Sales Appointments

NEW appointments in the commercial division of D. Napier and Son, Ltd., are announced. Cdr. G. N. Torry, R.N. (Retd.), joined the division on December 1st, and will be responsible to Mr. J. B. Waite, aero engine sales manager. Cdr. Torry was commissioned in the Royal Navy in 1929 and was attached to the R.A.F. for pilot duties in 1930. At the outbreak of war he was in command of No. 800 Squadron in H.M.S. *Ark Royal*, then from 1943 to 1945 he was attached to the Air Ministry for duties concerned with pilot training. From 1947 to 1952 he was at the Ministry of Supply, engaged on Naval aircraft development. During his flying career Cdr. Torry handled several Napier-engined aircraft, including the Lion-powered Fairey IIIF and Blackburn Dart.

Cdr. Torry.

On December 1st, also, Mr. W. E. Hampton, who joined the Napier commercial division in March as aviation export representative, was appointed aviation export manager.

Gas Turbine Technology Lectures

A COURSE of ten lectures under the title *An Introduction To Gas Turbine Technology* is shortly to be given at the Northampton Polytechnic, London, by Mr. Roy C. Orfold, M.Sc., C.P.A., A.M.I.E.E., patents manager of Power Jets (Research and Development), Ltd. The lectures will be given on Tuesday evenings, beginning on January 17th. The course will include a visit to the School of Gas Turbine Technology at Farnborough, Hants, which has one of the world's most comprehensive collections of sectioned gas turbines.

The course is intended for mechanical engineers of graduate or equivalent standard and the syllabus includes:—

Historical development. Constant-volume cycle. Early work on constant-pressure cycle: Brown-Boveri, Jondrassik, Lysholm, Whittle, Griffith.

Simple and compound, open and closed cycles. Effects of intercooling and reheat. Component efficiencies. Performance curves.

Theoretical calculations of compressor work input and turbine power output. Typical cycle calculation. Practical design considerations in main components, i.e., axial and centrifugal compressors, combustion systems, axial and centripetal turbines, recuperative and regenerative heat-exchangers.

Fuels: light and heavy oils, solid and gaseous fuels.

Applications of gas turbine plant. Aircraft propulsion, marine, motor vehicles, locomotives, base-load and stand-by power production, blast furnace blowing, chemical process and gas pipeline pumping.

Application for enrolment should be made to the Northampton Polytechnic, St. John Street, London, E.C.1.

IN BRIEF

Lustraphone, Ltd., state that their noise-cancelling microphone, with boom and swivel attachment and fitted to A.M.-type headset, has been given M.T.C.A. approval for use on U.K.-registered aircraft. A leaflet describing and illustrating the equipment is obtainable from the company's offices at St. George's Works, Regent's Park Road, London, N.W.1.

* * *

Ultra-light electric soldering tools receive considerable publicity, but it is not so often that an extra heavy tool comes to light. Such an instrument is now being produced by the Acru Electric Tool Mfg. Co., Ltd. It is designed to undertake work of a heavier gauge than would normally be practicable for an electric iron. This "Probit" tool weighs 8 lb, heats in 5 min, and consumes 450W. With the object of increasing its life, the element is of large area—over 11 sq in, and is also under pressure, thereby reducing oxidization of the resistance wire.

Mr. R. K. Deane, appointed production controller to R. B. Pullin and Co., Ltd. He was previously on the production staff of the Wilkinson Sword Co., and had spent many years in the aircraft industry in the United States and New Zealand.

Mr. K. F. Brown, who is leaving the Joseph Lucas organization in order to join Vandervell Products, Ltd. He joined Lucas in 1937 and since 1948 has been a director, and the secretary, of Rotax, Ltd., and Joseph Lucas (G.T.E.), Ltd.

Mr. G. Anthony Hepworth has been appointed to the Board of Hepworth and Grandage, Ltd., the Bradford manufacturers of pistons and associated components. He is the only son of Mr. E. Hepworth, the chairman and managing director.

* * *

A crash tender fitted with Redifon V.H.F. equipment played the leading rôle in a dramatic rescue at an airfield in Argentina recently. A jet pilot operating from Moron air Force base, near Buenos Aires, radioed that he would be making an emergency landing with undercarriage trouble. The crash tender crew maintained communications with the pilot throughout his approach and landing, and when the aircraft came to a standstill, bursting

THE INDUSTRY . . .

into flames, they were a mere 300 yards away. The flames were extinguished with foam and CO_2, the pilot extricated without injury, and the aircraft saved. The tender, equipped with a Redifon GR.261 radio-telephone, was manufactured by Sun Engineering (Richmond), Ltd., of Kingston-on-Thames.

* * *

Recently published British Standards include the following (obtainable at the prices shown from the B.S.I. Sales Department, 2 Park Street, London, W.1): B.S. SP 65, aluminium alloy taper pins for aeronautical purposes (1s); B.S. SP 66 and 67, cable thimbles for aircraft (1s); B.S. G.151, tachometer generators (synchronous type) for aircraft (3s); B.S. A.61 and A. 169-172, five specifications relating to aircraft bolts manufactured from aluminium alloy to B.S. L.65 (A.61, 2s 6d; others, 1s); B.S. 2S99, 80-ton 2½ per cent nickel-chromium-molybdenum steel for aircraft (2s).

* * *

Vickers-Armstrongs, Ltd., have initiated a special course for aircraft woodworkers—believed to be the only one of its kind in Britain—at The College, Swindon. Mr. W. Gillespie, the Principal, states that the course may be submitted to the City and Guilds of London Institute for recognition for examination purposes.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

High-altitude Ornithology

I WAS interested in the letter from Maurice Austin [Correspondence, December 9th], and possibly the following may be of interest to him.

Recently I have had the opportunity of flying Meteors around some of the higher peaks of the Andes. For reasons of safety, range, etc., these flights were normally carried out at 25,000ft plus.

On at least two occasions what must have been condors (judging by their size) were encountered at approximately 27,000ft. They appeared to be wheeling over the high valleys which had a break in the cloud above them. The drop in altitude from the top of a peak to the floor of a valley may sometimes be in the region of 20,000ft to 9,000ft in a few miles, so I came to the conclusion that they were over their feeding ground and not "in transit" across the mountains.

Quite often one encounters flocks of the local small vultures around 20,000ft. This is not surprising, since the Airport at La Paz in Bolivia is some 13,000ft high, and the birds are usually protected as scavengers.

Even condors seem to get lost occasionally. There is one in a cage at an airstrip in Brazil some 800 miles from the Andes. It was picked up in a state of exhaustion. It may have been caught in one of the high upper winds which are encountered at times.

Stroud, Glos. ANDREW MCDOWALL.

A Different Observer Corps?

YOUR correspondent Mr. Simmons rightly takes up the cudgels on behalf of the "spotting" abilities of the Royal Observer Corps.

I think, though, that the American gentleman who defended the inclusion of a B-17 shot in *The Dam Busters* was referring to the *Ground* Observer Corps (not the *R*.O.C.) whose problems and approach are different from those of their British counterparts.

Oxford. D. V.

Taking a Bow

I AM wondering if it has ever been suggested by any other readers of *Flight*, previous to this letter, that all record-breaking aircraft should be allowed a "lap of honour," as it were, over and around the capital immediately after the achievement.

Surely this could be arranged with the Powers that Be and a time and day allotted to this special flight. It would give great satisfaction to many to see the particular aircraft and no doubt impress a great many more who, at the moment, "couldn't care less."

Ilford, Essex. A. E. SMITH.

When Is A Jet Not A Jet?

ON November 29th B.O.A.C. issued a notice to the Press headed "Jets in West Atlantic: B.W.I.A. introduces Viscounts in Caribbean." Surely it is grossly misleading to say they are operating jets when they are using turboprops. Is this a prelude to telling the world that B.O.A.C. are again operating a jet service when the Britannias come into use?

When I raised this point with B.O.A.C. I was told: "The Viscount is a jet type and is now very commonly so called. The use of the word 'jet' is much more readily understood, in our view, than the term 'turboprop' . . . Not one person in a hundred among the general, uninitiated, public has the faintest idea what 'turboprop' means."

But two wrongs don't make one right. If the public are told the Viscounts and Britannias are jets, and they see airscrews, they will at least know they are not jets and will feel they have been misled. I believe that the knowledgability of the travelling public is very much underestimated. In any case, B.O.A.C. should help to spread knowledge—not pander to the lack of it.

London, S.W.3. GEOFFREY DORMAN.

Coming to Terms

WE are all, in this nuclear age, becoming accustomed to the idea that the chemical formulæ which we learned at school some thirty years ago were only partially true, but at any rate they were not wrong. It is therefore with something of a shock that I read the third paragraph of the left-hand column on page 270 of your issue of August 19th, 1955, under the heading "Man in Space," which seems to indicate that the cardinal principles of statistics and dynamics taught in my day were hopelessly off the beam.

Apparently a force is now to be measured in feet per second per second and then equated "in air density terms" (whatever that may mean) to a velocity in miles per hour, and this by some miracle causes the weight of an American Air Force lieutenant-colonel suddenly to become two tons.

Would it not have been just as simple and very much truer to say that the lieutenant-colonel had withstood a deceleration of so much, which is equivalent to the deceleration which would be brought about by his unprotected body moving at a speed of 1,800 m.p.h. through an air density normally to be found at 40,000ft?

Tokyo, Japan. R. C. K.

[It would.—Ed.]

FORTHCOMING EVENTS

Jan. 6. Helicopter Association: "Economic Production of Helicopters—Future Possibilities," by L. J. Harper.

Jan. 10. R.Ae.S.: Section Lecture: "Some Modern Structural Problems," by Prof. W. S. Hemp, M.A., F.R.Ae.S.

Jan. 12. R.Ae.S.: Presidential Address by N. E. Rowe, C.B.E., B.Sc., F.C.G.I., F.I.A.S., F.R.Ae.S.

Jan. 12-13. British Welding Research Association: London Meeting on Increasing Productivity by Welding.

Jan. 14. British Interplanetary Society: "Space Ship Instrumentation," by R. A. Waldron, B.A., Grad. Inst.P.

Jan. 14. Women's Engineering Society: New Year Luncheon.

Jan. 17. R.Ae.S.: Section Lecture: "Crack Detection in Aircraft Structures," by Dr. W. Deck, Federal Aircraft Factory, Switzerland.

Jan. 20. Institute of Navigation: Some Meteorological Aspects of High-Level Navigation—(1) "Jet Streams in Flight," by Capt. B. C. Frost (B.O.A.C.); (2) "Forecasting Jet Streams," by J. K. Bannon and T. H. Kirk (Meteorological Office).

Jan. 21. Aircraft Recognition Society: Ninth All-England Recognition Contest.

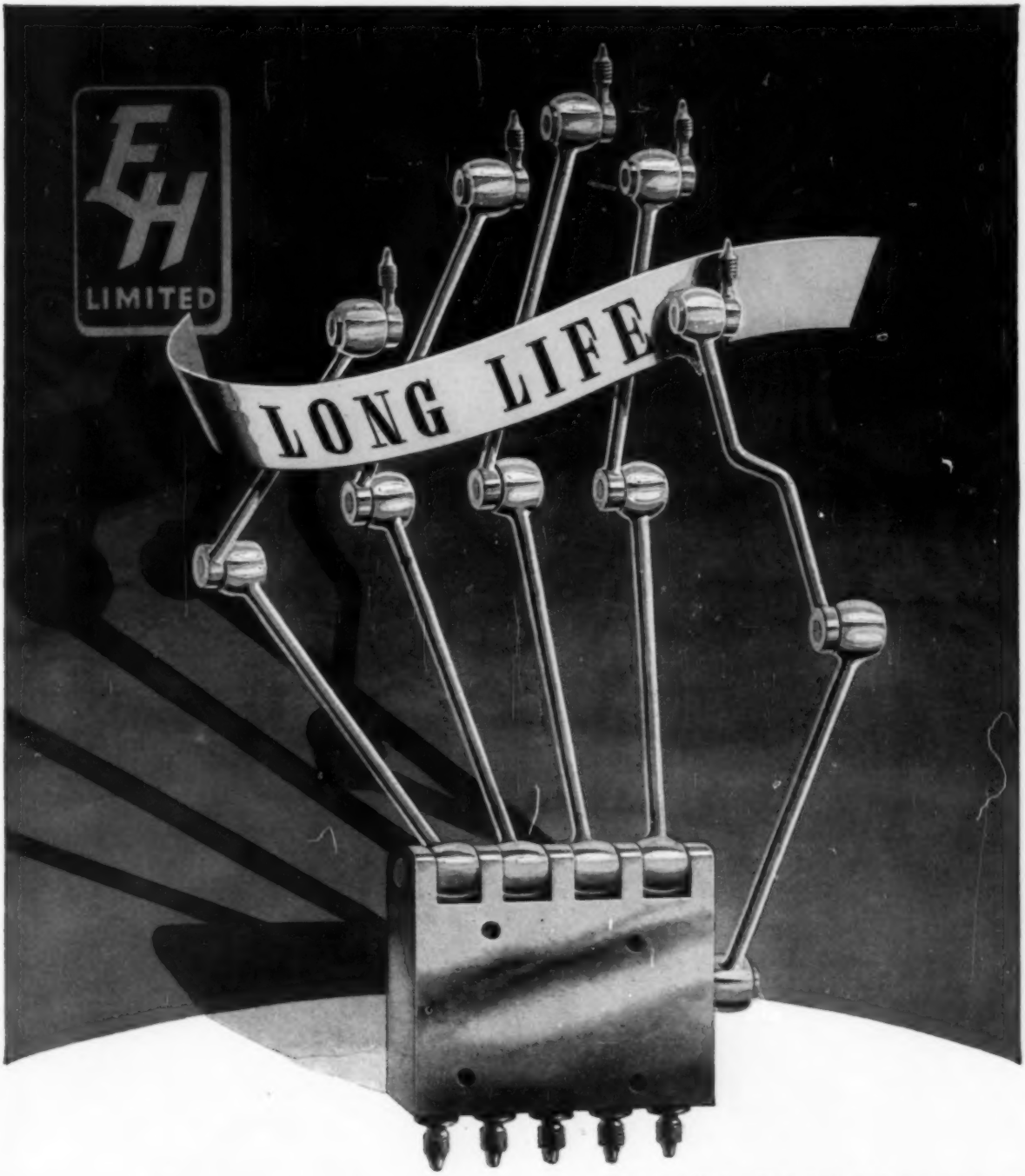
Feb. 10. Helicopter Association: "Helicopter Control Systems," by J. S. Shapiro, Dip.Ing., A.F.R.Ae.S.

Feb. 11. British Interplanetary Society: Birmingham Branch: "Aerodynamic Considerations of an Orbital Rocket," by W. F. Hilton, Ph.D.

Feb. 13. Institute of Transport: Brancker Memorial Lecture by R. S. Damon, President, Trans-World Airlines.

R.Ae.S. Branch Fixtures to January 26th:

Jan. 9, *Glasgow*, "Helicopters," by R. Hafner. Jan. 10, *Boscombe Down*, "Fatigue—the Metallic Deathwatch Beetle," by D. C. Smith; *Bristol*, "Aerodynamics and Associated Problems," by R. F. Creasey. Jan. 11, *Brough*, "Passengers and Freight Handling by Transport Command," by W/C. P. J. George; *Chester*, "Supersonic Flight," by G. A. V. Tyson; *Manchester*, "Analogue and Digital Computors Applied to Aircraft Design," by J. Arrowsmith; *Weybridge*, Brains Trust. Jan. 12, *Cheltenham*, "Liquid Springs: Progress in Design and Application," by A. E. Bingham. Jan. 17, *Bristol*, "Powerplants for Supersonic Flight," by Dr. E. S. Moult. Jan. 24, *Bristol*, "Aeroelastic Problems in Connection with High-Speed Flight," by E. G. Broadbent; *Belfast*, "The Turbulent Atmosphere," by E. Hyde. Jan. 26, *Isle of Wight*, "Interplanetary Flight," by A. V. Cleaver.



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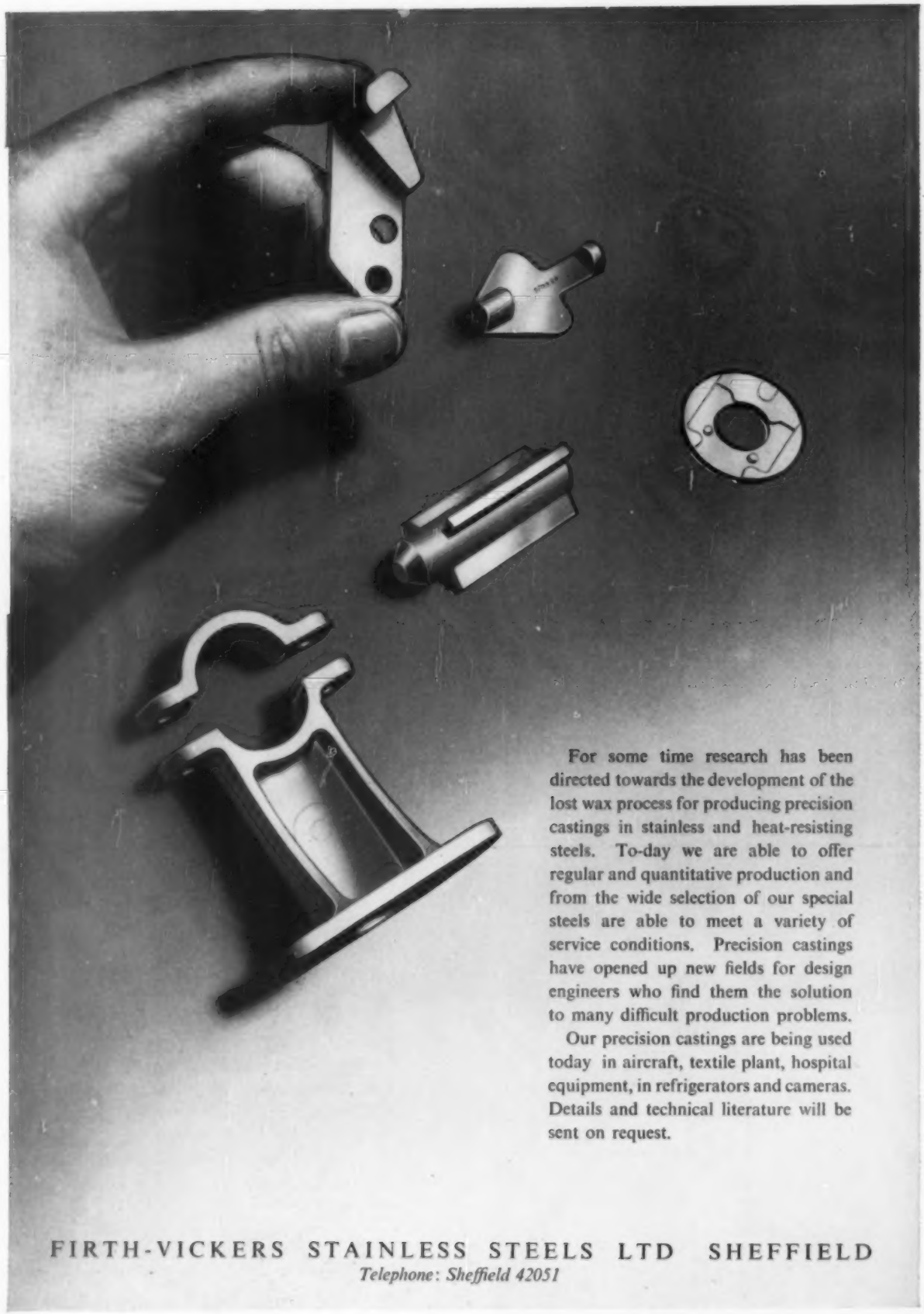

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CIVIL AVIATION

As recorded on this page, the first Douglas DC-7C made its maiden flight at Santa Monica on December 20th. Looking deceptively like its DC-6 and DC-7 predecessors, the Seven Seas is in fact a much more advanced airliner.

DC-7C FLIES

ELEVEN days ahead of the Douglas schedule, the first production DC-7C took off from the company's Santa Monica airfield on its maiden flight on Tuesday, December 20th. The aircraft flew for three hours in the hands of Douglas chief test pilot Bert Foulds, with A. G. Heimerdinger as second pilot. A scheduled first flight date of December 31st was called for in July 1954, when the Seven Seas was first conceived. The DC-7C, it will be recalled, is an enlarged version of the basic DC-7, with a 3ft longer fuselage and a 10ft greater wing span, enabling fuel capacity to be increased from 6,400 U.S. gal to 7,860 U.S. gal. Engines are the advanced model of the Wright Compound of 3,400 take-off h.p. Seven Seas have been ordered by PanAm, B.O.A.C., S.A.S., Sabena, K.L.M., Alitalia, Mexican, Braniff, Northwest, Swissair, and T.A.I.

EASTERN CHOOSE ALLISON

WHEN the first announcement was made of Eastern Air Lines' order for Lockheed Electras (*Flight*, September 30th) the choice of powerplant was left undecided, pending a comparative study of available British and American turboprops. Eastern now announce that their fleet of 40 Electras is to be powered by Allison 501 (military T56) turboprop engines of 3,750 s.h.p. The initial order with General Motors, Allison's parent company, provides for 200 Allison 501s; a simultaneous order with the Aeroproducts division of G.M. provides for a similar number of four-blade 13½ft turbine propellers. Eastern also have an option on a further 150 turbine-propeller units. As recorded in our issue of December 2nd, the Lockheed company have ordered two Rolls-Royce Tynes and two Napier Elands for evaluation as possible Electra powerplants.

AIRWORK VISCOUNTS SOLD

THE three Viscount 755s ordered by Airwork, Ltd., have been sold in advance of delivery to Compañia Cubana de Aviacion, S.A., of Havana. The aircraft are due for delivery over the next few months. Airwork state that sale of the Viscounts was dictated by lack of opportunities to utilize them fully, and that they will not order any more new aircraft unless there is a change in Government policy towards the independent operators. Another independent, Hunting-Clan Air Transport, recently leased three Viscount 732s to Middle East Airlines.

S.A.S., SABENA, AIR FRANCE BUY U.S. JETS—

FOLLOWING the K.L.M. decision to buy DC-8s (*Flight*, November 25th) three more European operators have announced orders for American jet airliners. They are S.A.S. (seven DC-8s), Sabena (three Boeing 707s), and Air France (ten 707s).

In announcing the Scandinavian order with Douglas, Mr. Henning Throne-Holst, S.A.S. president, said in Stockholm on December 21st: "We are convinced that the future of long-range aviation lies with the jet transport." Douglas state that S.A.S. are considering the use of Rolls-Royce Conway engines instead of Pratt and Whitney J75s. Delivery of the S.A.S. DC-8s will begin during the first quarter of 1960.

Sabena announced their order for three 126-passenger Boeing 707 "Intercontinentals" (see below) on December 28th, for operation on the Brussels-New York and Brussels-Belgian Congo routes, beginning "in the spring of 1960." The same day, M. Max Hymans, president of Air France, announced in Algeria his order for ten 707 Intercontinentals, with an option on another six. The order will be completed within a year from November, 1959. Much prominence was given to the Air France order in the French Press on December 29th. *L'Aurore* said: "Britain has now lost the enormous market for four-jet airliners."

Pan American-Grace brought the DC-8 order-book to 110 on December 28th with a contract for four aircraft plus an option on two. The Boeing 707 score to date is 75.

—AND BOEING DISCLOSE LONG-RANGE 707

THE Sabena and Air France orders for 707s recorded above are for the new longer-range version, to be known as the Stratoliner Intercontinental. Compared with the domestic 707, as ordered by American, Continental and Braniff, the overwater Intercontinental has increased power, payload and tankage, and will be the type used by transatlantic operators. (PanAm have substituted Intercontinentals for 12 of their order for 20 707s.)

Comparative data for the domestic 707 and the Intercontinental are: all-up weight 240,000 lb and 290,000 lb; payload 28,000 lb and 36,000 lb; tankage 17,400 U.S. gal and 21,200 U.S. gal; length 134½ft and 146ft 8in; span 130ft 10in and 141ft 6in; wing area increased by 475 sq ft.

Engines of the 707 Intercontinental (and presumably the overwater DC-8) will be Pratt and Whitney JT4A-3s (civil J75s), estimated at between 17,000 lb and 18,000 lb thrust each—a considerable advance on the JT3 (civil J57) of the domestic 707, estimated at 13,000 lb with water injection.

MORE ELECTRAS ORDERED

VALUED at £16.5m, an order for 20 Lockheed Electras has been placed by National Air Lines. It brings the number of Electras now sold to 104, with 30 more on option. Twelve of National's Electras will be delivered between April and December 1959, the remainder following in 1960.

Log-books of the first Britannias to be delivered to B.O.A.C. were handed over to Sir Miles Thomas on December 30th by Sir Reginald Verdon Smith (right), chairman of the Bristol Aeroplane Co. Their expressions provide all the commentary needed on the occasion, which is reported on page 5.

CIVIL AVIATION . . .

AIR FRANCE ORDER SUPER Gs

TWO days after the announcement of Air France's order for 10 Boeing 707s came the news from Lockheed that the French airline has placed an order for four L.1049G Super Constellations for delivery "early in 1957," at a cost, it is reported, of more than $8m (£2.8 million). This is in addition to the Air France order for 12 L.1649s for delivery in 1957.

TRANS-CANADA's "MEMORABLE YEAR"

IN his yearly review of T.C.A.'s operations during 1955 Mr. G. R. McGregor, president of Canada's state airline, recalled that the year's activities included the carriage of the ten-millionth passenger since the trans-continental service started in 1937. In addition turboprop Viscount services had been introduced to North America on April 1st, and Canada's first scheduled air cargo service had been inaugurated by T.C.A. Their routes now linked Canada with the U.S.A., United Kingdom, Iceland, France, West Germany, Bermuda and the West Indies.

1955 TRAFFIC UP BY ONE-FIFTH

AT the turn of the year I.A.T.A. recorded that traffic on the world's scheduled airlines increased by 20 per cent during 1955, and shows signs of even greater expansion this year. Sir William Hildred, Director-General of I.A.T.A., said that the number of passengers in 1955 was 70m compared with 59m in 1954; cargo and mail had increased in about the same proportion. "We may carry 85m passengers in 1956, and reach the 100m mark in 1957." During this period operators will, of course, be preoccupied with the financing of the greatest re-equipment programme the industry has ever undertaken, involving orders for turbine transports totalling over £357m.

U.A.L.'s $150m FINANCE PROGRAMME

UNITED Airlines, who recently announced an order for 30 DC-8s costing, with spares, $175m (£63m) have completed arrangements for what is believed to be the largest single airline financing programme to date. Mr. W. A. Patterson, U.A.L. president, said that the company has provided for a maximum of $150m to be available over the next five years. Of this amount, $120m is to be available from the sale of new debentures, and up to $30m is to be borrowed under credit agreements. The debentures, at 4 per cent, will be sold as funds as required to three insurance companies: Metropolitan Life, Prudential (America) and Mutual Life. The terms of the agreements provide that the $120m may be sold as needed over the next several years.

The credit agreement is with a group of 38 banks headed by the First National City Bank of New York. Effective as from December 1st, it will make loans available up to December, 1960, with repayments up to the end of 1965. Commented Mr. Patterson: "With the accomplishment of this programme United is assured that it will be in a strong position to meet the financial needs of the jet age."

INDEPENDENCE FOR C.A.A.

A NEW voice, that of the Aircraft Owners and Pilots Association of America, has been raised in support of the proposal to return the United States Civil Aeronautics Administration to an independent status. The A.O.P.A. president, Mr. J. B. Hartranft, said: "The time has come when industry must demand politicians to stop playing 'patsy' with the C.A.A." He pointed out that the last three Administrators, including Mr. Fred Lee, had served on the average only 21 months in office. Hartranft said that unless C.A.A. could again be independent of petty political influences, another new Administrator could be similarly removed "at the mere caprice" of someone in high political office. He continued: "In the interest of flying safety and the preservation and expansion of civil air power in the United States, the job of administering C.A.A. must be based upon merit, and must not be trifled with by 'pork-barrel' politics." He argued that civil aviation could never achieve sound long range planning on air transport affairs while the chief officials responsible for such programmes "were bounced in and out of office like tennis balls." The 33 months during which Mr. Lee had been in office had involved "incessant Commerce Department sniping and bushwhacking over plans for air navigation facilities, airport expansion and other fundamental aviation policies." Such factors had led to the undermining of morale at lower levels within C.A.A., claimed Mr. Hartranft.

The Monroney proposal to restore independent status to C.A.A., it is felt by A.O.P.A., will remove non-aviation pressure from the Commerce Department and afford a C.A.A. Administrator "a clear and unobstructed channel for improvement programmes for civil aviation."

EXCHEQUER GRANTS TO B.O.A.C AND B.E.A.?

ALTHOUGH both B.O.A.C. and B.E.A. are now operating at a profit, and B.O.A.C. has received no Exchequer grant since 1951, it is understood that the Government are likely to review the Exchequer's power to make grants to the Corporations, which is due to lapse on March 31st, 1956. While Treasury assistance may be unnecessary, legislation to retain the power to make grants in an emergency is likely to be reviewed by the Government shortly. In view of the strong criticism from independent airline quarters that more scope should be given to private operators, it seems likely also that, at the same time, the Government will be pressed to include such provisions as outlined in the terms of the "new deal" of 1952.

LONDON-PARIS BACK TO NORMAL

B.E.A. is due to resume its full timetable services, including the Silver Wing flight, between London and Paris as from tomorrow, January 7th. Services since last Monday have been gradually stepped up. As reported in *Flight* for November 25th, services have been restricted since the strike of French airport staff began early in November. During the restrictions there have been five London-Paris daily flights by B.E.A., who have been using the military airfield of Creil. Flying from Le Bourget was due to be resumed on January 1st; although the staff were still on strike, the control tower was being operated by the French Air Force.

PACIFIC ISLAND BATTLE

THE New Zealand newspaper *Auckland Star* on December 30th foreshadowed a clash between Pan American World Airways and Tasman Empire Airways for the control of tourist traffic to the Pacific islands. The opening by PanAm of a service between Fiji and American Samoa in January is, the newspaper states, the first move by PanAm to cut into routes now dominated by T.E.A.L. "Once established there, PanAm is certain to spread its Pacific net further, even working into Tasman's prize tourist preserve, Tahiti." Earlier this year PanAm's decision to operate three services a week between Auckland and Fiji led to protests by the New Zealand Government against "unfair competition," and the matter is still being discussed in talks in Washington.

BREVITIES

IN a recent message to the staff of A. V. Roe Canada, Ltd., Sir Roy Dobson, chairman of the company, referred to a 1,500 m.p.h. airliner of which a preliminary study is now being made by Avro. No further details were given.

* * *

The Supreme Court of Victoria has awarded £24,000 to the widows and families of three Trans-Australia Airlines pilots killed in the T.A.A. Viscount training accident at Mangalore, Victoria, on October 3rd, 1954.

* * *

Capt. I. R. Stephens, acting manager of B.O.A.C.'s Constellation Fleet, has been appointed assistant to the Corporation's deputy operations director, Mr. H. O. Houchen. Capt. Stephens is succeeded by Capt. T. B. Stoney, formerly a member of the Comet Fleet.

* * *

Mr. Stanley Gewirtz has been elected vice-president of the Air Transport Association, it is announced in Washington by A.T.A.'s president, Mr. Stuart G. Tipton.

* * *

B.E.A.'s manager in France, Col. Selwyn Gerald Carr, O.B.E., died in Paris on December 28th. He had served with the Corporation since 1946.

* * *

Trans World Airlines celebrated their 30th anniversary during 1955 by flying a total of more than four million passengers on a 33,000-mile route network, an increase of 13 per cent over the 1954 figure. Tourist services represented about 58 per cent of domestic passenger miles, and 80 per cent of international passenger miles. Air cargo and mail had increased also.

* * *

Stockholm radio reports that S.A.S. are negotiating with Danish, Norwegian, Canadian and American authorities for the establishment of radio aids in the North Polar regions. These would serve the future Great Circle route between Scandinavia and Japan, and, it is hoped, would be ready for the inaugural flight in the autumn of this year. S.A.S. would supply equipment and would help to install it; the stations would be run by the appropriate countries.

This good-looking Learstar is used for business travel by the United States Steel Corporation. Furnished for 13 passengers and equipped with Bendix storm-warning radar, it was engineered from a standard Lodestar by Lear Inc. of Santa Monica.

Hunting-Clan Air Transport announced on December 29th the appointment of Mr. Clive Middleton, M.A., as cargo sales supervisor. In his new post Mr. Middleton will be mainly concerned with the promotion of Hunting-Clan's "Africargo" between the U.K. and Africa.

* * *

T.W.A. has asked C.A.B. for permission to extend its service east from its present Colombo and Bombay terminals to Bangkok and Manila. This would permit connections at the latter centre with North West Airlines and provide an alternative U.S. air link between the Philippines and South Asia. It is understood that PanAm are likely to oppose T.W.A.'s request for what is in effect a competitive "globe-circling" service.

Despite the French Airports strike, over the Christmas holiday B.E.A. carried about a quarter more passengers than at Christmas 1954. Up to Christmas Day something like 300 extra services to and from London were flown.

* * *

Before the end of their tour of India, Mr. Bulganin and Mr. Kruschev presented Mr. Nehru with an Il-14 airliner at a ceremony at Delhi Airport.

* * *

Iberia, the Spanish national airline, have placed an order with Lockheed for two Super-G Constellations for delivery in the middle of next year. The company inaugurated transatlantic services in 1954 with three 1049C Super Constellations.

FROM THE CLUBS

THIS month's activities at the Kronfeld Club, 74 Eccleston Square, London, S.W.1, include a talk by Mr. F. N. Slingsby, of Slingsby Sailplanes, Ltd., on January 11th; *The Future of Gliding*, a talk by Philip Wills, on January 18th; and a programme of Shell and B.O.A.C. films on January 25th. All begin at 8 p.m.

THE Christmas dinner of the Elstree Flying Club was held at the Plough Hotel, Elstree on December 19th. Col. H. C. Butcher, past chairman of the club, reported that in the first eleven months of 1955 over 3,000 hours had been flown by members, compared with a total of 2,609 for the whole of 1954. Twin-engine conversions had been introduced during the year, and night flying had proved popular when the weather permitted. At busy times during the summer, however, flying activity was at saturation point, and there was urgent need of improvements to the aerodrome itself.

Guest of honour at the dinner was W/C. C. A. Pike, O.B.E., A.F.C., who recalled in his speech the early days of light aircraft. Commenting on the club's activities, he referred to the winning of the Lennox-Boyd Trophy and expressed his full support for the flying discipline insisted on at Elstree. After the dinner, there was dancing to a two-piece band, while at the bar the keener types talked flying shop (Elstree-style).

SOME 30 members of the Hampshire Aeroplane club attended a most successful dinner following the annual general meeting on November 26th. The occasion represented a small-scale revival of the annual dinner for the first time since the war, and on view were photographs of a more lavish pre-war function attended by the club's president, Lord Louis Mountbatten.

Reviewing recent events, Mr. V. H. Bellamy (manager of the club) stated that the 1,050 hr flown during the year had been rather a disappointing total in view of the fine summer. Also disappointing was the lack of support from the many local aircraft companies, only one of which was participating in the Works Flying Clubs scheme. On the other hand, club membership had increased to 159, including seven private owners. A number of members had attended continental rallies in 1955, the longest-distance flight being to Tangiers.

Social events at Eastleigh are continuing throughout the winter, with recent co-operation from local branches of the Royal Observer Corps and the R.A.F.A. The club's chief ground engineer is now Mr. John Currie who, it may be remembered, was the designer and constructor of the pre-war lightplane known as the Currie Wot.

NEW chairman of the Vintage Aeroplane Club is Mr. R. P. Green, who has taken over from Capt. Ron Gillman. Denys Stonebanks and Len Harridan have also retired from the committee of the club, which is planning a full programme for 1956. The list of committee members now comprises D. S. Bootle, F. Buckell, R. Mayes, J. A. B. Ogilvie and D. C. G. Wright, with Mrs. D. Green as hon. treasurer and Mrs. J. Bootle as hon. secretary.

TYRE unserviceability threatens to ground the well-known Comper Swift G-ABUS, David Ogilvy reports, unless a pair of serviceable Goodyear 16 × 7-3 aero covers can be obtained. Information regarding a possible source in this country would be welcomed by Mr. Ogilvy at Elstree Flying Club, Elstree Aerodrome, Herts (Elstree 3070).

AMONG the large selection of light and executive aircraft currently available to American pilots are three improved versions of Beechcraft machines, the G-35 Bonanza, D-50 Twin-Bonanza and the E-18 Super 18 executive transport.

The new Bonanza, claimed to be the fastest four-seat aircraft on the market, cruises at 190 m.p.h. (75 per cent power) or 184 m.p.h. (65 per cent power). The standard powerplant is the 225 h.p. six-cylinder Continental E-225-8, previously available as a higher-powered alternative to the 205 h.p. Continental. Other new features of the G-35 are a reinforced airframe structure, instrument-panel safety-guard, revised heating and ventilating system, redesigned nosewheel strut, electric engine-temperature gauge and other redesigned engine instruments, and new interior styling.

The 1956 version of the Twin-Bonanza has improved performance, resulting largely from the increased power (295 h.p.) of the Lycoming high-compression engines. Hartzell three-bladed airscrews are fitted, and cruising and top speeds of 203 and 214 m.p.h. respectively are claimed. The aircraft is available as either a five-seater or a six-seater, and the baggage capacity has been increased to accommodate 450 lb. Total useful load of the D-50 is 2,319 lb, and maximum range 1,650 miles. Similar detailed improvements to those described above on the Bonanza are incorporated.

Prizewinners in the Northamptonshire Aero Club's summer flying competitions received their trophies at a dance at the Sywell clubhouse on December 3rd. Seen with the club's flying instructor, Mr. L. C. Hilditch, and Mrs. Hilditch (who presented the prizes) are Miss Barbara Webb ("Find your way home" competition), Mr. J. A. Wardley (best student pilot of the year), Mr. C. Boddington (navigation), and Mr. J. G. Thomas (general flying).

Left to right: Sir Robert Saundby (K.C.B.), Dr. W. Cawood (C.B.), A. Cdr.W. E. G. Mann (C.B.), R. S. Stafford (C.B.E.), G/C. D. R. S. Bader (C.B.E.).

THE NEW YEAR HONOURS

Aviation Names: Civil Service Outweighs Industry

AERONAUTICAL interest in the New Year Honours List, published last Monday, is this year confined largely to officers of the various Ministries, the aircraft industry being poorly represented. One well known designer, however, is honoured—Mr. R. S. Stafford, technical director of Handley Page, Ltd. (C.B.E.)—as is a test pilot, Mr. G. A. V. Tyson, of Saunders-Roe, Ltd. (O.B.E.); Mr. Tyson, incidentally, is now handing over his post of chief test pilot to a successor, as shown in the photograph on page 9 of this issue.

Prof. A. G. Pugsley, of Bristol University, who receives a knighthood, will be remembered as the head of the Structural and Mechanical Engineering Department of the Royal Aircraft Establishment during the war years, and as chairman of the Aeronautical Research Council in 1952.

Air Marshal Sir Robert Saundby, who retired from the R.A.F. in 1946 and who has since devoted much time to ex-Service organizations, is appointed K.C.B.

G/C. Douglas Bader, Shell's air operations adviser, who is famed for his flying exploits with artificial legs, is appointed C.B.E. in recognition of the work he has done for the disabled.

One of the senior officials in technical posts in the Ministries, and whose names appear in the list, is Dr. Walter Cawood, who until recently was the Ministry of Supply's Principal Director of Scientific Research (Defence), and is now their P.D.S.R. (Air). He is appointed C.B.

Among civil-division recipients of the Queen's Commendation for Valuable Service in the Air is S/L. J. S. Fifield, who recently subjected himself to low-altitude tests of the new Martin-Baker ejection seat.

Names of R.A.F. personnel receiving honours in the Military Divisions of the various orders are given in "Service Aviation," on the opposite page.

BARON

Sir Frederick Godber, chairman, Shell Transport and Trading Co., Ltd.

KNIGHT BACHELOR

A. G. Pugsley, Professor of Civil Engineering, University of Bristol.

ORDER OF THE BATH

K.C.B.

Air Marshal Sir Robert Saundby, vice-chairman, Council of Territorial and Auxiliary Forces Associations.

C.B.

W. Cawood, Principal Director of Scientific Research (Air), Ministry of Supply; F. R. Howard, Assistant Under-Secretary of State, Air Ministry; A. Cdre. W. E. G. Mann, Director-General of Navigational Services (Civil Aviation), Ministry of Transport and Civil Aviation; W. J. Richards, Director, Radar Research Establishment, Ministry of Supply.

ORDER OF THE BRITISH EMPIRE

C.B.E.

G/C. D. R. S. Bader (for services to the disabled); S. H. Clarke, Director, Fire Research Station, Department of Scientific and Industrial Research; R. Graham, Director of Aircraft Research and Development, Ministry of Supply; H. V. Hayes, Director, Air Technical Publications, Ministry of Supply; H. F. Hodgson, managing director, Joseph Sankey and Sons, Ltd., Bilston, Staffs; T. Paris, assistant secretary, Air Services, "A" Division, Ministry of Transport and Civil Aviation; A. Reid, assistant secretary, Ministry of Supply; R. S. Stafford, technical director, Handley Page, Ltd.; G. Steel, general managing director, United Steel Cos., Ltd., Sheffield.

O.B.E.

H. H. Allen, assistant director, accounts division, Ministry of Transport and Civil Aviation; J. J. Bryan, chief engineer, Singapore Airport; A. V. Gill, secretary, East African Airways Corporation; F. E. Halliwell, senior chief executive officer, Air Ministry; P. W. Hubbard, principal, Air Ministry; Capt. E. W. Jordan, flight manager, Jersey Flight, B.E.A.; J. E. Lambert, principal, Air Ministry; J. R. Leclaire, deputy director of studies and training, Royal Pakistan Air Force Apprentice School; C. C. Morley, chief engineer, Maintenance Command, R.A.F.; J. D. Morton, senior principal scientific officer, Ministry of Supply; H. Parish, chief engineer, Henry Wiggin and Co., Ltd., Birmingham; F. H. Perkins, education officer, I.C.I., Ltd., J. C. Perry, First Assistant Secretary, Department of Air, Canberra; S. F. Prentis, lately chief executive officer, R.A.E., Farnborough, Ministry of Supply; Maj. W. Ronnie, Chief Constable, Civil Aviation Constabulary, Ministry of Transport and Civil Aviation; G. Thripp, deputy principal Indian Air Force Technical Training College, Jalahalli; G. A. V. Tyson, chief test pilot, Saunders-Roe, Ltd., Cowes; H. G. Vyse, chairman, R.A.F. Benevolent Fund committee in Jamaica; R. C. Warren, principal inspector of accidents, accidents investigation branch (civil aviation), Ministry of Transport and Civil Aviation.

M.B.E.

A. J. A. Armstrong, engineer technician, Grade I, R.A.E., Ministry of Supply; Obs. Lt. G. D. Austin, senior liaison officer, No. 1 Group, Beckenham, Royal Observer Corps; E. B. W. Bennett, higher executive officer, Air Ministry; R. A. Bourlay, superintendent of flying, Central African Airways; A. Bowen, mechanical engineer, British Thomson-Houston Co., Ltd., Rugby; R. C. Butters, chief machine progress superintendent, Enelish Electric Co., Ltd., Stafford; C. E. Cox, higher executive officer, Air Ministry; F. A. Crouch, inspector, Aeronautical Insoection Directorate, Ministry of Supply; A. K. Dewdney, officer-in-charge, movements control, B.O.A.C.; S/L. T. M. Dutton, chairman of committee, No. 1366 (City of Chester) Squadron, A.T.C.; I. J. D. Edwards, traffic manager, London Airport, Airwork, Ltd.; Mrs. Eleanor Gough, teleprinter superintendent, London Airport; F. C. Hall, higher executive officer, Air Ministry; R. G. Hodges, senior experimental officer, Radar Research Establishment, Ministry of Supply; T. L. Howson, senior educational officer, Royal Pakistan Air Force Apprentice School; Miss Thelma Julian, estimates and analytical studies officer, B.O.A.C.; E. A. Kelly, civilian officer, R.A.F. Luqa, Malta; E. L. Killip, operations research and planning manager, B.E.A.; W. S. Martin, chief inspector, Brown Brothers (Aircraft), Ltd., Northampton; W. M. Searle, superintendent inspector, Aeronautical Inspection Service, No. 25 Maintenance Unit, R.A.F. Hartlebury; Miss Alma Norton-Smith, clerical officer, H.Q. Maintenance Command, R.A.F.; H. J. Trotman, higher executive officer, Air Ministry; S. C. Turner, higher executive officer, Ministry of Transport and Civil Aviation; E. W. J. White, higher executive officer, Air Ministry; H. C. Williams, lately fitting shops manager, Bristol Aeroplane Co., Ltd.; J. G. P. Zierold, technical manager, Briggs Motor Bodies, Ltd., Dagenham.

ROYAL VICTORIAN ORDER

M.V.O. (FOURTH CLASS)

W/C. B. P. T. Horsley, R.A.F.

BRITISH EMPIRE MEDAL

J. W. Anderson, engineer driver, R.A.F. Station Netherbutton, Orkney; D. F. W. Archer, radio operator (supervisor), R.A.F. Cheadle, Staffs; C. H. J. Cotten, shop foreman, 47 Maintenance Unit, R.A.F. Hawarden; E. J. Dawe, clerk of works, R.A.F. Uxbridge; R. R. Lusted, research and experimental mechanic, R.A.E., Farnborough; A. McLeod, motor transport fitter, Wick Airport; A. B. Pearce, general works foreman, Schermuly Pistol Rocket Apparatus, Ltd.; R. J. Saunders, chargeman fitter, R.N. Air Station Ford; T. J. Tindall, civilian warrant officer, No. 148 (Barnsley) Squadron, A.T.C.; M. H. Vincent, Technician Grade II, Empire Test Pilots School, R.A.E., Farnborough; M. Wetherell, chief observer, Post N.3 Whitburn, No. 23 Group, Royal Observer Corps.

QUEEN'S COMMENDATION FOR VALUABLE SERVICE IN THE AIR

P. G. Archer, lately Assistant District Commandant, Kenya Police Reserve Air Wing; Capt. J. Dall, pilot, West African Airways Corporation; S/L. J. S. Fifield, test pilot, Martin Baker Aircraft Co., Ltd.; Capt. R. L. Gillett, aircraft captain, B.O.A.C.; M. O'Donovan, flight production manager, Central African Airways; Capt. F. Ormonroyd, Superintendent of Aircraft Requirements and Operating Procedures, B.E.A.; R. G. Pakenham-Walsh, District Commandant, Kenya Police Reserve Air Wing; Capt. R. F. Robinson, senior captain, second class, B.E.A.

ROYAL VICTORIAN MEDAL

(SILVER)

Sgt. J. R. Whitehead, R.A.F.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

Half-yearly Promotions

IN the half-yearly list of promotions taking effect from January 1st, Air Marshal Sir Dermot A. Boyle, K.C.V.O., K.B.E., C.B., A.F.C., is appointed Chief of the Air Staff and promoted to the rank of air chief marshal, in succession to Marshal of the Royal Air Force Sir William F. Dickson, G.C.B., K.B.E., D.S.O., A.F.C.

The following air vice-marshals in the General Duties Branch are promoted to air marshal: D. Macfadyen, C.B., C.B.E., Sir George R. Beamish, K.C.B., C.B.E. (acting air marshal), and Sir Bryan V. Reynolds, K.C.B., C.B.E. (acting air marshal).

Birthday Honours

THE New Year Honours list, published last Monday as a special supplement to the *London Gazette*, includes the names of a number of R.A.F. recipients of honours in the military divisions of the various orders.

Among names of senior officers in the Honours List is that of Air Chief Marshal Sir Basil Embry (Commander, Allied Air Forces, Central Europe), who is appointed a Knight Grand Cross in the Order of the Bath. In the same Order, Knights Commanders are Air Marshal L. Darvall, who until recently was Commandant of the NATO Defence College, and A.V-M. D. Macfadyen, Commandant of the R.A.F. Staff College.

ORDER OF THE BATH (Mil. Div.)

Knight Grand Cross: Air Chief Marshal Sir Basil Embry, K.C.B., K.B.E., D.S.O., D.F.C., A.F.C.

Knights Commanders: Acting Air Marshal L. Darvall, C.B., M.C.; A.V-M. D. Macfadyen, C.B., C.B.E.

Companions: A.V-M. D. H. F. Barnett, C.B.E., D.F.C.; A.V-M. A. Earle, C.B.E.; A.V-M. W. M. L. MacDonald, C.B.E., D.F.C.; Act. A.V-M. W. J. M. Akerman, C.B.E.; A. Cdre. G. Bearne; A. Cdre. G. J. C. Paul, D.F.C.; G/C. J. M. Birkin, D.S.O., O.B.E., D.F.C., A.F.C., R.Aux.A.F.; Act. A. Cdre. R. A. C. Carter, D.S.O., D.F.C.

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Further awards (A.F.C.s, B.E.M.s, Queen's Commendations, etc.) will be printed in our next issue.

R.A.A.F. Senior Appointments

IT is announced that A.V-M. W. L. Hely, C.B.E., A.F.C. has been appointed Air Officer Commanding, R.A.A.F. Training Command, Melbourne. For the past two years he has been Deputy Chief of the Air Staff, R.A.A.F. At Training Command he replaces A.V-M. A. M. Murdoch, C.B.E., whose appointment was recently announced as the first Assistant Secretary Military in the Australian Department of Defence.

A. Cdre. C. T. Hannah, C.B.E., R.A.A.F., has been appointed Senior Air Staff Officer at the R.A.F.'s Far East Air Force Headquarters in Singapore. This appointment has been given to an R.A.A.F. officer by agreement between the R.A.F. and the R.A.A.F. as part of the plan to integrate Australian officers in those R.A.F. Headquarters which will control the operations and training of R.A.A.F. units serving in Malaya. In 1953 A. Cdre. Hannah became the first Director-General of Personnel and was appointed C.B.E. in the 1954 Birthday Honours List. He has just returned to Australia after attending the 1955 course at the Imperial Defence College.

The appointment is also announced of W/C. I. J. Roberts, who now becomes Senior Air Staff Officer at R.A.A.F. Overseas Headquarters in London. For the past two years he has been Staff Officer to the Chief of the Air Staff, Air Marshal Sir John McCauley, K.B.E., C.B.

Junior Harness

NEW seat harness, designated lap-strap Type Y, has been developed to cater for children riding in the rearward-facing seats of R.A.F. passenger aircraft. The harness consists of a standard lap-strap with a special short belt for children incorporated with it. It will be fitted in Valettas and Hastings as well as in Beverleys. This is believed to be the first case of the introduction of such a harness in either civil or military flying.

1,000 Jet Hours

THE first R.A.A.F. pilot to complete 1,000 hours in jet aircraft is F/O. T. Stoney, of No. 2 O.T.U., Williamtown, N.S.W. At present he is flying Avon-Sabres. Much of his early jet experience was gained during the Korean war in Meteors of No. 77 Sqn., and he has now flown three types, Meteor, Vampire and Sabre. F/O. Stoney flew with Nos. 456 and 35 Sqns. during the war and re-enlisted in 1948.

A new portrait of Air Chief Marshal Sir Basil Embry, who commanded Allied Air Forces Central Europe until his retirement on December 31st. Sir Basil's successor is Air Chief Marshal Sir George Mills.

No. 10 Squadron

EARLY this year No. 10 Squadron will be presented with its Standard, and for the occasion a full history of the squadron is to be compiled. Accordingly, F/O. B. A. Mellor is anxious to contact all ex-members who have information and/or photographs which may be of interest. He assures us that every care will be taken of the material sent to him at No. 10 Squadron, Royal Air Force, c/o Air Ministry, and all photographs, etc., will be returned where requested.

"One of the Few" Raised £10,000

AN appeal for the Royal Air Force Benevolent Fund made last Battle of Britain Sunday by an anonymous pilot described simply as "One of the Few" has, it is now announced, raised £10,015. Among the 8,265 people who sent money were 2,055 anonymous donors.

Air Ministry Appointments

TAKING up the post of Director of Operations (Bombing and Reconnaissance) at the Air Ministry this month is G/C. B. K. Burnett, D.F.C., A.F.C., who, for the past 18 months, has commanded the V-bomber station at R.A.F., Gaydon, Warwickshire—No. 232 Operational Conversion Unit, which trains Valiant crews for Bomber Command. G/C. Burnett himself qualified as a first pilot on Valiants.

Born at Hyderabad and educated at Charterhouse and Oxford, G/C. Burnett joined the O.U.A.S. in 1932 and was granted a permanent commission in the R.A.F. two years later. After a period with No. 18 (Bomber) Squadron, he took the specialist navigation course and in 1937 joined the Long Range Development Unit. He was co-pilot, a year later, of one of the Wellesleys which established a new world long-distance record by flying non-stop the 7,162 miles from Ismailia to Darwin. For his part in this flight, G/C. Burnett was awarded the A.F.C.

When war broke out in 1939 he was on the staff of H.Q. Advanced Air Striking Force, and later served with Nos. 1 and 4 Groups. He was given command of a Whitley bomber squadron (No. 51) in

As recorded last week, the command of No. 56 Squadron (Hunters) has been taken over by Major Jules E. H. Kaisin (Belgian A.F.). He is seen here seated with (left) F/O. H. Munro, F/O. C. M. Christie and Capt. Clinton G. Gillespie, a U.S.A.F. officer serving as a flight commander on exchange posting.

SERVICE AVIATION . . .

May, 1941, and was awarded the D.F.C. at the end of his operational tour. At the end of 1941 he went to Canada to spend two years on navigation duties, returning home to become S.A.S.O. of No. 25 (Training) Group. He has since been on the directing staff of the R.A.F. Staff College, at the Air Ministry as a Deputy Director of Plans, and at No. 3 (Bomber) Group as S.A.S.O. G/C. Burnett has represented the Service at squash, has won the R.A.F. championship five times and has played for England. He won the R.A.F. tennis singles title twice and the doubles six times.

Cresta Hopes

THE R.A.F. team to defend the Inter-Services Cresta Run championship at St. Moritz on February 4th will soon begin training in Switzerland. Two newly acquired toboggans are among their equipment.

The R.A.F. has held the championship since its inception in 1949. This year's Cresta team is headed by F/L. D. Knight, the first individual winner of the Combined Services' championship in 1949. The Inter-Services Cresta championship was held as an individual event from 1949 until 1953, and in 1954 it became a team event, with four entries per team. For 1956 teams of six will compete.

The team also has an eye on the Curzon Cup, and if in practice matches some of the members sufficiently impress the St. Moritz Toboggan Club they might be invited to compete.

R.A.F. at London Exhibitions

THE R.A.F. is participating in two exhibitions currently open in London: the Schoolboys' Own Exhibition began last Saturday at the Horticultural Hall, Westminster, and closes on January 14th, and the National Boat Show at Olympia opened on December 29th, and will continue until January 10th. There will also be R.A.F. exhibits at the Hotel and Catering Exhibition at Olympia from January 19th-29th, and at the Ideal Home Exhibition in March.

The R.A.F. stand at the Schoolboys' Exhibition features a cinema, built to resemble an aircraft's cabin, which is showing a film about a low-level high-speed flight across country by a Hawker Hunter. An Avon engine is also on view, together with models of the latest R.A.F. fighters and bombers. R.A.F. personnel are on duty to answer questions.

At the National Boat Show, the R.A.F. are showing marine equipment used by Coastal Command, and dinghies of the R.A.F. Sailing Association. The main Coastal Command exhibit is one of the new lightweight reinforced glass fibre dinghies used by flying-boat squadrons and marine craft units. Representing the recreational side of life in the R.A.F. is a 12-ft National dinghy, 30 of which were built by the R.A.F. in the Suez Canal Zone for competitions on the Great Bitter Lake.

2nd T.A.F. Pembrokes

BASED at R.A.F. Station Wildenrath, Germany, the communications squadron of the 2nd Tactical Air Force is now receiving Hunting Percival Pembroke light transport aircraft as replacements for its Avro Ansons. Pembrokes are already being used in the Middle East and Far East Air Forces on communications duties. Among other duties the 2nd T.A.F. Pembrokes will be used as ambulances on the cas.-evac. service between Germany and England. Because of its nosewheel undercarriage the Pembroke does not subject casualties to changes of attitude during take-off and landing, as did the Anson.

No. 6 Squadron's Double

BOTH major operational competitions for fighter squadrons of the Middle East Air Force have been won by No. 6 Squadron. They are the Lloyd Trophy for the best all-round squadron, and the "Imshi" Mason Memorial Trophy for air weapons proficiency. No. 6 Squadron is commanded by S/L. P. C. Ellis, D.F.C., equipped with D.H. Venoms, and based at Habbaniya, Iraq.

Marking for the Lloyd Trophy (presented by Lord Lloyd of Dolobran when he was High Commissioner in Egypt) takes into account general operational efficiency, all-weather flying, freedom from accidents, aircraft serviceability, achievement of squadron flying task and efficiency in the use of air weapons. The "Imshi" Mason Trophy (presented by Mrs. T. Mason in memory of her son, S/L. E. M. Mason, D.F.C., killed in combat over the Western Desert while leading Nos. 94 and 112 Squadrons) is awarded solely for efficiency in air weapons training. It takes its name from S/L. Mason's nickname, "Imshi."

This is the third time that No. 6 Squadron has won the Lloyd Trophy; it is also the unit's third victory in the "Imshi" Mason competition. On a fourth occasion No. 6 Squadron tied with No. 249 for the "Imshi" Mason Trophy.

Royal Air Force Appointments

THE following continues recent lists of Royal Air Force appointments as announced by the Air Ministry:—

G/C. H. P. Pleasance, O.B.E., D.F.C., to R.A.F. Nicosia, to command; G/C. A. V. R. Johnstone, D.F.C., to Air H.Q., Malaya, for air staff duties; G/C. D. Michell, to H.Q., M.E.A.F., for administrative staff duties; G/C. F. R. Carey, D.F.C., A.F.C., D.F.M., to H.Q., Fighter Command, for air staff duties; G/C. P. H. Wood, to H.Q., F.E.A.F., for administrative staff duties; G/C. C. J. Salmon, O.B.E., to H.Q., No. 40 Group, for air staff duties.

W/C. D. D. Rogers, O.B.E., to R.A.F. Seletar, to command (with the acting rank of group captain); W/C. J. H. S. Broughton, D.F.C., A.F.C., to United Kingdom Services Liaison Staff, Pretoria, as assistant air adviser; W/C. P. Meston, to R.A.F. Church Fenton, for administrative duties; W/C. R. J. Lewis, to H.Q., No. 90 Group, for technical staff duties; W/C. E. W. Deacon, D.S.O., D.F.C., A.F.C., to Air H.Q., Ceylon, for air staff duties; W/C. A. G. Sutton, O.B.E., to H.Q., No. 90 Group, for administrative staff duties; W/C. R. H. C. Sampson, to the R.A.A.F., for exchange technical duties; W/C. G. W. Kirby, M.B.E., to R.A.F. Patrington, to command; W/C. V. A. Tidey, to R.A.F. Seletar, for technical duties.

S/L. E. J. B. Brown, to Air Ministry, for duty in the department of the Chief of Air Staff (with the acting rank of wing commander); S/L. W. R. J. Marriott, to R.A.F. Celle, for technical duties (with the acting rank of wing commander); S/L. F. Ruskell, D.F.C., to Air Ministry, for duty in the department of the Chief of Air Staff (with the acting rank of wing commander); S/L. B. Spray, to R.A.F. Marham, for administrative duties (with the acting rank of wing commander); S/L. D. W. B. Farrar, D.F.C., A.F.C., to R.A.F. Odiham, for flying duties (with the acting rank of wing commander); S/L. W. Laing, A.F.C., to R.A.F. Driffield, for flying duties (with the acting rank of wing commander); S/L. F. W. Davison, to R.A.F. Wahn, for flying duties (with the acting rank of wing commander).

An eruption of caps in the traditional style on the occasion of the passing-out parade of the 73rd entry of aircraft apprentices from R.A.F. Halton. The reviewing officer was Air Marshal Sir George R. Beamish.

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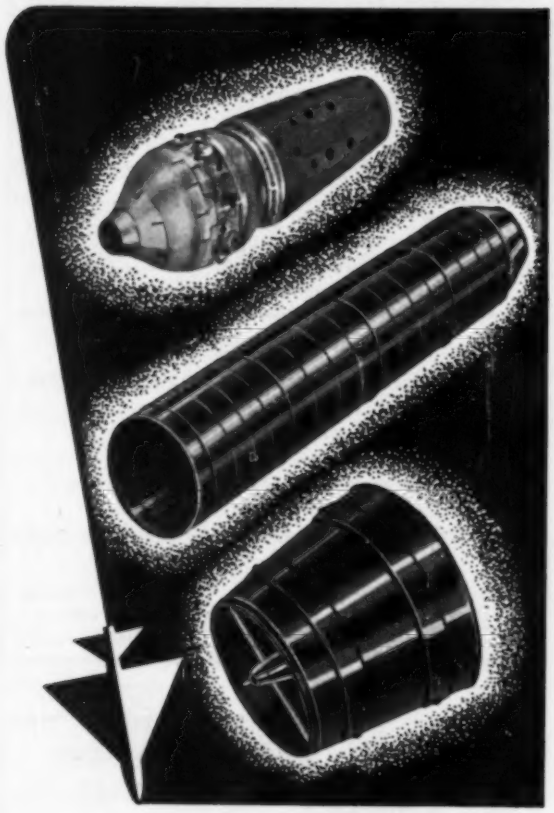

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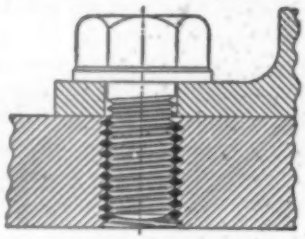

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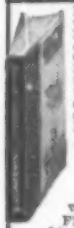

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THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:

APPLICATION No. 474/2. From Air Charter, Ltd., of 15, Great Cumberland Place, London, W.1, for an amendment to their Vehicle Ferry Service which the Company have been approved to operate between Southend and Ostend until June, 1961, so as to operate at a frequency in accordance with the traffic offering instead of one return flight daily as at present authorised.

FROM Cambrian Airways, Ltd., of Collingdon Road, Cardiff:

APPLICATION No. 21/3. For an amendment to their U.K. Internal Service which the Company have been approved to operate between Liverpool and Guernsey and/or Jersey via Cardiff and/or Bristol until 1st May, 1963, so as to double the frequency at present authorised.

APPLICATION No. 411/1. For an amendment to their Normal Scheduled Service which the Company have been approved to operate between Cardiff and/or Bristol and Nice (Le Var) via Southampton (optional stop) until 31st March, 1963, so as to increase the frequency from two to four return flights weekly, when the service is operated with D.H. Heron instead of with Dakota aircraft.

FROM British European Airways of Keyline House, Ruislip, Middlesex, for the following U.K. Internal Services to be operated with Pionair, Elizabethan and Viscount aircraft for the carriage of passengers, supplementary freight and mail at a frequency according to traffic demand during the Summer season in 1956 only and subsequently throughout the year for a period of 10 years commencing 1st July, 1956:

APPLICATION No. 694. For a service between Aberdeen, Edinburgh and Jersey.

APPLICATION No. 695. For a service between Belfast and Jersey.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the application may be obtained.

WHEN an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [4664

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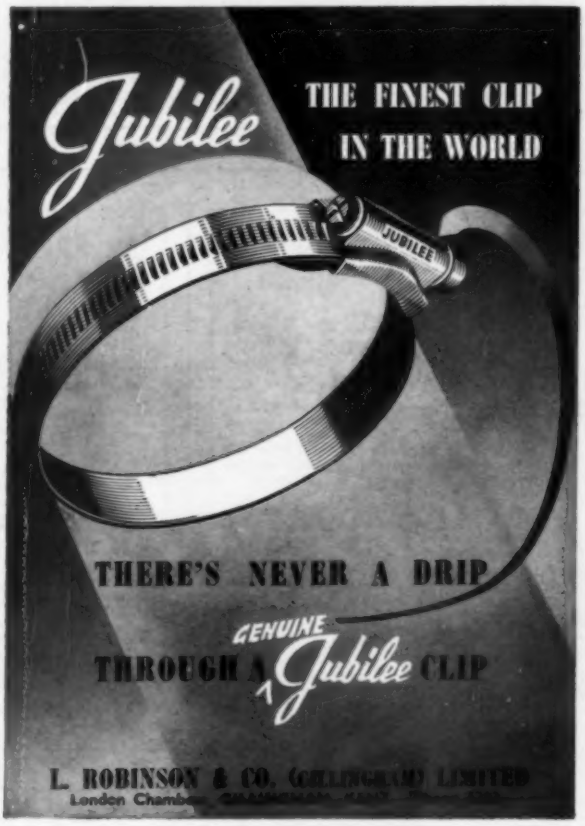

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